UMASS/AMHERST
312066 0271 2688 7

Digitized by the Internet Archive
in 2012 with funding from
Boston Library Consortium Member Libraries

http://archive.org/details/coastwidefishery8384mass

MASS. EA31.2: C63/983-84

Division of Marine Fisheries.

V

UNITED STATES

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

COMMERCIAL FISHERIES RESEARCH AND DEVELOPMENT ACT

FINAL REPORT

State: Massachusetts

Sub-Project No.: 3-375-R-1

Project Title: Coastwide Fishery Resource Assessment

Sub-Project Title: Fishery Resource Assessment, Coastal Massachusetts

Period covered: January 21, 1983 - January 20, 1984

Prepared by: Arnold B. Howe, Senior Marine Fisheries Biologist Date: 4/24/85
Thomas P. Currier, Marine Fisheries Biologist
Sherry L. Sass, Assistant Marine Fisheries Biologist
Brian C. Kelly, Assistant Marine Fisheries Biologist

Approved by: W. Leigh Bridges Assistant Director Date: June 5, 1985

Statement of Project Accomplishment

(Not for Publication)

GOVERNMENT DOCUMENTS
COLLECTION
1985
University of Massachusetts
Depository Copy

PUBLICATION:# 14080-99-33-6-85-C.R.
APPROVED BY Daniel Carter, State Purchasing Agent

TABLE OF CONTENTS

Page Number

FIGURE AND TABLE LIST, Job 1

ABSTRACT

Job 1: Fishery Resource Assessment, Coastal Massachusetts

INTRODUCTION 1

FIELD AND ANALYTICAL PROCEDURES 1

RESULTS AND DISCUSSION 2

SPRING CRUISE #8391 2

AUTUMN CRUISE #8392 4

ACKNOWLEDGEMENTS 5

REFERENCES 6

Job 2: Evaluation of winter flounder year-class success

INTRODUCTION 7

METHODS 7

RESULTS AND DISCUSSION 9

REFERENCES 10

FIGURE AND TABLE LIST, JOB 1

Sampling strata used in Massachusetts DMF inshore bottom trawl survey . . . . Figure 1

Mean bottom water temperatures encountered on spring (—) and autumn (----) survey cruises of Massachusetts inshore waters, 1978-83 . . . . Figure 2

Allotment of sampling effort to Massachusetts inshore strata, 1983 survey cruises . . . . Table 1

Summary of 1983 Massachusetts Division of Marine Fisheries bottom trawl survey cruise effort and collection, Massachusetts territorial waters . . . . . Table 2

Weight (kg) and number of species collected during the 1983 spring and autumn bottom trawl surveys, Massachusetts territorial waters . . . . Table 3

Average bottom temperature (°C) by depth interval and region, Massachusetts inshore bottom trawl surveys, spring and autumn, 1983 . . . . Appendix Table 1

	Stratified mean catch per tow, estimates of precision and average weight per individual for all Massachusetts inshore strata sets, spring and autumn, 1978-1983.	Stratified mean numbers per tow (untransformed) by length frequency intervals for regions 1-5, Massachusetts inshore bottom trawl survey, spring and autumn, 1983.
All species	Appendix Table 2	
Atlantic cod	Table 3	Table 4
Haddock	Table 5	Table 6
Silver hake	Table 7	Table 8
Red hake	Table 9	Table 10
White hake	Table 11	Table 12
Scup	Table 13	Table 14
Black sea bass	Table 15	Table 16
Tautog	Table 17	Table 18
Ocean pout	Table 19	Table 20
Northern searobin	Table 21	Table 22
Longhorn sculpin	Table 23	Table 24
Yellowtail flounder	Table 25	Table 26
Winter flounder	Table 27	Table 28
Summer flounder	Table 29	Table 30
American plaice	Table 31	Table 32
Witch flounder	Table 33	Table 34
Windowpane	Table 35	Table 36
Atlantic herring	Table 37	Table 38
Butterfish	Table 39	Table 40

Sand lance	Table 41	Table 42
Spiny dogfish	Table 43	Table 44
Little skate	Table 45	Table 46
Winter skate	Table 47	Table 48
Longfin squid	Table 49	Table 50
American lobster	Table 51	Table 52
Rock crab	Table 53	Table 54

ABSTRACT

In 1983, the Massachusetts Division of Marine Fisheries continued its standardized semiannual bottom trawl survey program to monitor relative abundance of fish stocks in state territorial waters. In three-week, daytime, spring and autumn cruises, 96 and 90 stations, respectively, were completed. Seasonal abundance and distribution of 26 finfish and shellfish species were described by comparing computer-generated relative abundance indices (stratified mean catch in kilograms and number per tow) to 1978-82 indices.

In spring, some commercially important species (e.g., Atlantic cod, winter flounder, scup, black sea bass, and longfinned squid) were recorded at a higher level of biomass than in 1982; however, the 'all species' index showed a 9% decrease. Of 11 species noted at a lower level, five were at record lows including yellowtail flounder. Of those showing increases, nine were at record high biomass levels including longfinned squid, haddock (age 1+), silver hake, and Atlantic herring. The mean spring bottom water temperature approximated the average for the previous six similarly timed cruises.

Autumn seabed water temperatures were the warmest of the timeseries. When the fall results were compared to those of one year earlier, many indices of abundance for age 0 and prerecruit-size fish showed downward trends including those of Atlantic cod, yellowtail flounder, scup, black sea bass, and longfinned squid. Adults also showed declines in abundance, notably summer flounder. Overall, 20 species were less abundant in biomass; of these, five were at record low levels including silver hake. At their highest levels in the autumn timeseries were witch flounder and American lobster, the latter reversing the situation noted in spring. Seasonal changes in the indices for silver hake, witch flounder, and American lobster may indicate distributional and availability flucuations and do not necessarily signify changes in population abundance.

A standardized beach seine survey designed to quantify winter flounder spawning success in southern Cape Cod estuaries was undertaken for the ninth consecutive year. The stratified mean density index for the 1983 year-class was the weakest of the timeseries and significantly weaker than most others, foretelling poor 1986 recruitment to the stock unit. The 1979 cohort, represented by the second highest index in the timeseries, proved to be a major component of research trawl catches from 1981-83 and appears to have supported commercial landings in 1982-83.

Job 1: Fishery Resource Assessment, Coastal Massachusetts

INTRODUCTION

The Massachusetts Division of Marine Fisheries (DMF) has conducted a semiannual bottom trawl survey of the waters within the jurisdiction of the Commonwealth since 1978. State territorial waters are described by a three nautical mile wide border extending from the Rhode Island to New Hampshire boundaries including Cape Cod Bay and Nantucket Sound. Specific cruise objectives were to: 1) estimate relative abundance of groundfish and certain shellfish species in terms of weight and numbers; 2) determine periodic trends in fish abundance, population structure, and species composition; 3) collect information on age and growth, maturity, mortality, and recruitment; and 4) describe groundfish distribution in relation to temperature, salinity, and depth.

This survey series has been partially funded through the Commercial Fisheries Research and Development Act (PL 88-309) through 1985 under project 3-375-R. The 1978-1982 cruises have been fully described (Howe et al. 1982). This report summarizes the general status of fisheries resources noted on the 1983 cruises (#8391 and #8392).

FIELD AND ANALYTICAL PROCEDURES

The National Oceanic and Atmospheric Administration's (NOAA) R/V GLORIA MICHELLE (65', 365 SHP) was chartered for both 1983 cruises. The DMF provided standard sampling gear - a 3/4 North Atlantic type two-seam trawl (39' headrope/ 51' footrope). Net mesh varied depending upon the section (3.5", 2.5", 1.5") and the codend liner measured 0.64 cm (0.25"). The trawl was fished with a rubber disc (3.5") chain sweep, rectangular wooden doors (6' x 40", 325 lbs.) and 10-fathom legs.

The study area was divided into 5 physiographic regions which were subdivided into depth strata (Figure 1). Individual strata were grouped by regions (strata sets) to make data meaningful for resource managers. The regions are: 1) Buzzards Bay, Vineyard Sound, and coastal waters south of Martha's Vineyard; 2) Nantucket Sound; 3) east of Cape Cod, Race Point to Muskeget Island; 4) Cape Cod Bay; and 5) Massachusetts Bay north to the New Hampshire border.

One hundred stations were allocated to strata approximately in proportion to the area of each stratum (Table 1). General station locations were predetermined by conventional random selection methods. If towable bottom was unavailable at the designated location, alternate sites within that stratum were utilized. As on previous surveys, 20 minute daytime tows were made along depth contours at a speed of 2.5 knots with trawl warp scoped at 3:1.

In processing the catch, standard survey techniques and trawl logs were employed. Following the catch sort by species, weights and length frequencies were recorded. Materials for aging, requested special samples, and biological observations were routinely collected.

Standard survey abundance indices were computed using Northeast Fisheries Center (NEFC) and DMF software and the Woods Hole Oceanographic Institute's Digital VAX-11/750 computer. Completed trawl logs were entered by NEFC personnel. Station and biological data were audited to detect recording and entry errors and processed by DMF personnel using the NEFC Survey Analysis Program (SURVAN). For each designated species, SURVAN computed mean catch/tow in kilograms and numbers by strata, strata set, and cruise, then produced an average individual weight, and length frequency listing. Total weight and numbers by species for each tow, stratum, strata set, and cruise were computed by the DMF SPPTOT program. For each of 26 species, two survey indices are presented: the stratified mean catch per tow (kilograms) for all strata sets, 1978-1983, and the stratified mean number per tow by length frequency interval (cm) and region, 1983 (Appendix tables 2-54).

RESULTS AND DISCUSSION

A summary of 1983 survey cruise effort and collections is presented in Table 2. A total of 378,259 organisms weighing 34,792.7 kg and representing 95 fish and shellfish species were collected and processed during 1983 surveys (Table 3). Fifteen species comprised 88% of catch weight and, excluding 51,233 mussels < 1 cm caught in one tow, also accounted for 88% of the total catch in number for 1983.

SPRING CRUISE #8391

Many of the commercially important species showed an increase in abundance over the previous spring. Nevertheless, the biomass index for 'all species' combined showed a 9% decrease relative to 1982 values.

Beginning with the species caught principally in the inshore waters of the inner Gulf of Maine, spring biomass and number indices, expressed as stratified mean weight/tow and stratified mean number/tow, respectively, of the following species more than doubled that of 1982: haddock (mostly yearling fish, 15-26 cm), "harbor" pollock, and silver hake (Gulf of Maine stock). Based on previous good survey catches of age 1 pollock and subsequent above-average recruitment, 1983 catches would suggest an above average year-class and potentially strong future recruitment. The witch flounder weight index rose 34%. Ocean pout and longhorn sculpin catch indices reached timeseries highs.

Atlantic herring indices increased seven-fold, with the 1981 cohort relatively more abundant than any prior one taken on spring surveys. This was also the most abundant year-class we had observed as brit in southern Cape Cod estuaries during summer, 1982, and 2-3 months later was abundant in Cape Cod Bay according to our autumn, 1982 trawl survey.

The Gulf of Maine cod stock indices were either up or down compared to 1982 depending on the size grouping. Young-of-the-year (YOY) were 44% less numerous while juvenile (15-32 cm) numbers doubled. The American plaice numerical index declined 33% but the biomass index remained unchanged; it appeared that yearling dab had not moved inshore in usual numbers.

Yellowtail flounder indices were at the lowest levels of the six year timeseries. Most of the spring survey catch of yellowtail flounder was represented by age groups 2 and 3 as identified by length-frequency modes at 26 and 36 cm.

South and east of Cape Cod, marketable scup ($\geq$ 15 cm) abundance was up four-fold from the previous spring, yet still well below the timeseries average. Whereas in earlier springs (1978-80), five length-frequency modes corresponding to ages 1-5 were apparent, in 1981-82 survey catches were bimodal, mainly ages 1 and 2 present. In 1983, 80% of the catch was comprised of two-year-olds (17 cm mode).

Although summer flounder biomass declined only 12%, the number index was 40% lower than last spring's timeseries high, implying a lower rate of recruitment. Windowpane and tautog biomass diminished by 37% and 12%, respectively. Rising to timeseries highs were indices for the southern New England silver hake stock, which quadrupled and black sea bass, which doubled. Northern sea robin biomass declined 28%, yet was still 90% above the previous five-year average. For the region east and south of Cape Cod, Atlantic cod young-of-the-year (YOY), presumably of the Georges Bank stock, declined for the second consecutive spring (35%).

Longfinned squid (Loligo) catch indices increased five-fold to a six year high. Very abundant spawning biomass resulted from a particularly strong influx of the larger spawners ($\geq$ 30 cm), 36-month survivors of an early (spring) 1981 cohort, which were 2-3 times more abundant than usual. Also contributing to the banner commercial landings was a relatively abundant 1982 late (summer) cohort represented in the spring survey by a 4 cm mode which recruited somewhat later in the season.

Coastwide, red and white hake abundance doubled from last spring's timeseries lows. The numerical index of alewife and blueback herring each doubled. The survey catch of American lobster declined 30% to the survey low. Rock crab abundance declined approximately 50%, continuing a 3-year downward trend.

Abundance of winter flounder, both prerecruit ($\leq$ 27 cm) and all-size fish, increased in all survey regions and 65% statewide. Divergence between the elevated survey index and the downward trend in reported commercial landings from state waters would suggest that either the 1983 winter flounder indices may be anomolous, in which case we have no plausible explanation for this phenomena, or that the 1982 cohort, which recruited to the trawl survey at age 2 but not to the commercial fishery, is stronger than its predecessor. There is evidence supporting the latter theory detailed in the accompanying report updating the estuarine YOY winter flounder survey.

As shown below, coastwide bottom water temperatures recorded during the spring survey were approximately 1° C higher than the 1982 spring bottom temperatures, the coldest in the timeseries (Figure 2, Appendix table 1). Averaging 8.9° C, temperatures were higher in every region and close to the timeseries average.

SPRING

		Average Temperature (°C)		Average Salinity °/oo
Year	Cruise dates	Surface	Bottom	Surface
1978	12 May-11 Jun	13.1	10.7	30.9
1979	30 Apr-27 May	11.2	8.9	30.9
1980	5 May-24 May	10.6	9.1	31.9
1981	6 May-21 May	9.8	8.5	30.7
1982	4 May-21 May	10.2	7.8	31.9
1983	9 May-25 May	10.3	8.9	31.1

AUTUMN CRUISE #8392

During September, bottom water temperatures south and east of Cape Cod were the highest in the autumn survey timeseries (Figure 2, Appendix table 1). Although an equipment failure negated bottom measurements north of the Cape, high surface values suggest an increase in bottom temperatures over last year in that area as well. The coastwide trend is as follows:

AUTUMN

		Average Temperature (°C)		Average Salinity °/oo
Year	Cruise dates	Surface	Bottom	Surface
1978	5 Sep- 2 Oct	16.1	12.8	31.8
1979	11 Sep- 4 Oct	15.3	12.6	31.5
1980	8 Sep-29 Sep	17.8	14.3	31.8
1981	14 Sep- 5 Oct	16.4	15.4	31.7
1982	8 Sep-27 Sep	17.0	13.3	32.5
1983	7 Sep-24 Sep	19.5	*	31.7

Autumn survey catches are generally characterized by a preponderence of pre-exploitable size fish of most species. In 1983 indices of abundance for age 0 or YOY of important species were lower than in 1982. Atlantic cod were 69% less plentiful, though numbers were comparable to 1981 catches. A large drop in YOY numbers from Massachusetts Bay more than offset increases in Cape Cod Bay and the outer Cape region. Juvenile cod were scarce, more so than in any previous autumn survey. Very few haddock YOY were caught; the number index was the lowest since 1978. Scup YOY were 18% less abundant than the timeseries high in 1982; catches were 21% above the timeseries average. Similarly, production of black sea bass was down 46% from the 1982 high but was substantially greater (50%) than the 5-year average. Following the same pattern, the Loligo YOY (or prerecruit) index declined 40% from the high in 1982, but approximated the average value for the timeseries.

Forecasting future exploitable biomass, prerecruit indices for other important species also showed downward trends. The yellowtail flounder index (age 1+) was 31% below average and approximated the 1982 value. The majority

*Coastwide mean value not calculated due to equipment failure in regions 4 and 5.

of the autumn catch of silver hake consists of one-year-olds; indices have been steadily dropping, except in 1982, since the fall surveys began. The 1983 catch was 11% below that of 1981. Winter flounder prerecruit numbers were down slightly (4%) from the 1982 high, but were still well above (40%) the survey average. Prerecruit butterfish ($\leq$ 11 cm) were about as plentiful as last fall.

Adult stages for several species also showed declines in abundance. The summer flounder biomass index dropped sharply (37%) from the 1982 high, but it was the same as the timeseries average. Similarly, winter flounder declined from high values (34% and 20% by weight and number), but were close to timeseries means. White hake, windowpane, and sand lance catches in terms of both weight and number were at record lows.

The rock crab biomass index declined 53% from 1983 and 38% from the timeseries averages. Although spring and fall trends for rock crab abundance have often been contradictory, 1983 weight and number indices decreased in both seasons to the second-lowest values in the timeseries. This consistency may indicate an actual decline in abundance rather than simply a temporary change in availability. By contrast, more American lobsters were taken than ever before.

Catch increases for several species are more apt to reflect increased abundance inshore than real increases in population. Adult scup reappeared south of Cape Cod after being scarce in 1982 to exceed the timeseries average by 20%. More witch flounder were caught in the deeper water (> 37 m) north of Cape Cod than ever before; weight and number indices were 113% and 170%, respectively, above the 5-year averages. In the same general area, numbers of American plaice rose to the highest level since 1978, climbing 42% over the 5-year average due primarily to a significant increase of yearlings (1982 year-class). The Atlantic herring biomass index rose for the third year in a row, to a timeseries high. Red hake indices were the second highest in the timeseries.

Because huge schools of spiny dogfish were not inshore in September as in some prior years, the 'all species' weight index was down (54%) from the dramatic increase in 1982. When spiny dogfish catches are removed from the database, the 'all species' decline is insignificant and the trend relatively stable.

ACKNOWLEDGEMENTS

We are grateful for the continuing efforts and support of the NMFS/URI Engineering Group, especially the Captain and crew of the R/V GLORIA MICHELLE, including Lt JG Gary Bulmer, Lt JG John Bailey, John Kenney, Lt John Moakley, Vern Nulk, and Al Blott.

We thank W. Leigh Bridges who administered this project, reviewed this report and, along with 27 other Division Staff, assisted at sea. The assistance

of 16 guest scientists on board and the timely help of other Division staff who gave logistical support was gratefully appreciated. The following personnel of the NEFC/Woods Hole Laboratory aided in resolving problems with data processing: Linda Despres-Patanjo, Philip Chase, Wayne Hoover, and Jim Sargent.

REFERENCES

Howe, A. B., T. P. Currier, S. L. Sass, and B. C. Kelly. 1982. Coastwide Fishery Resource Assessment. Mass. Div. Marine Fish. 1-20.

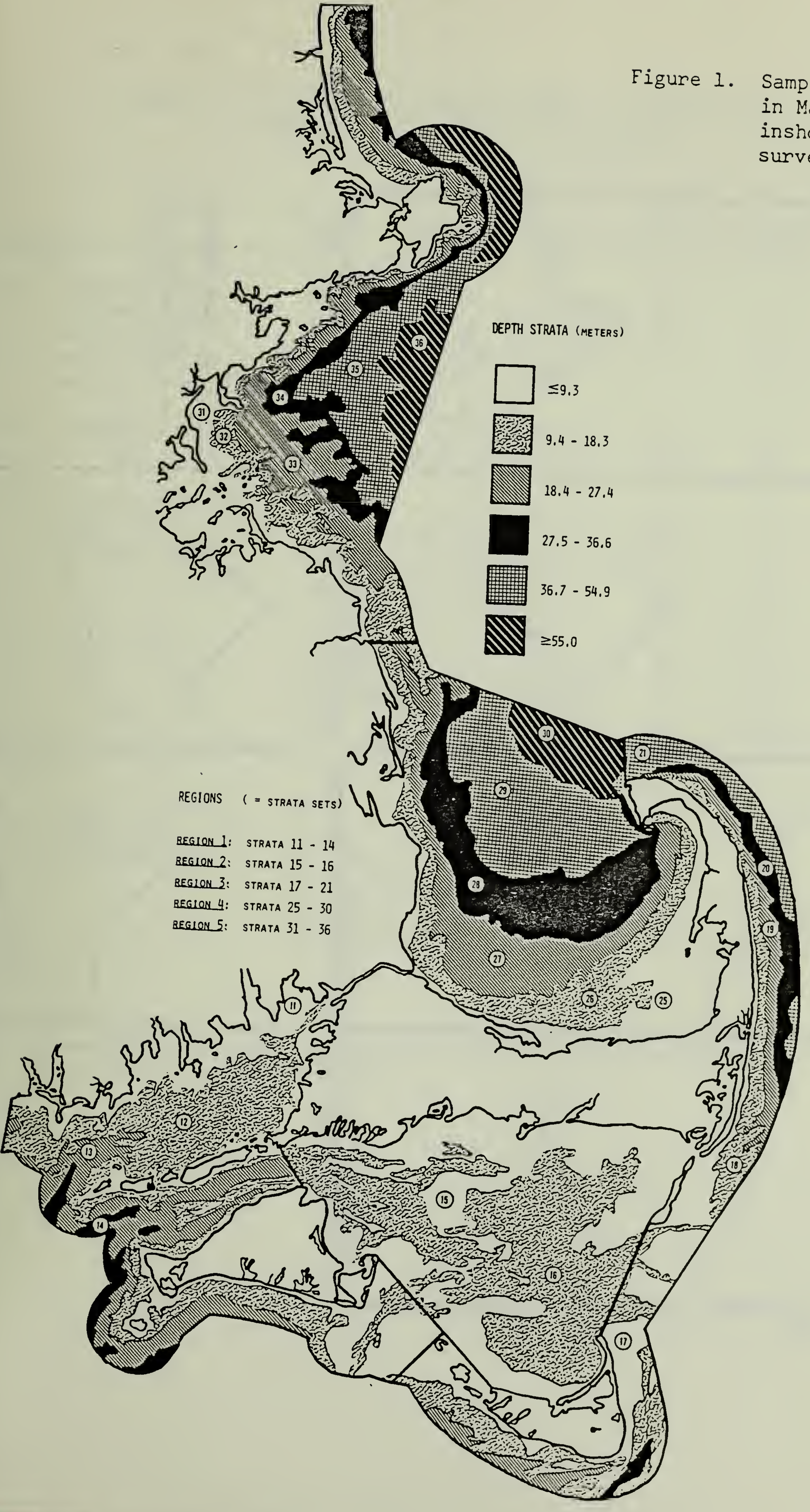

Figure 1. Sampling strata used in Massachusetts DMF inshore bottom trawl survey.

Figure 2. Mean bottom water temperatures encountered on spring (——) and autumn (···) DMF survey cruises of Massachusetts inshore waters, 1978-1983.

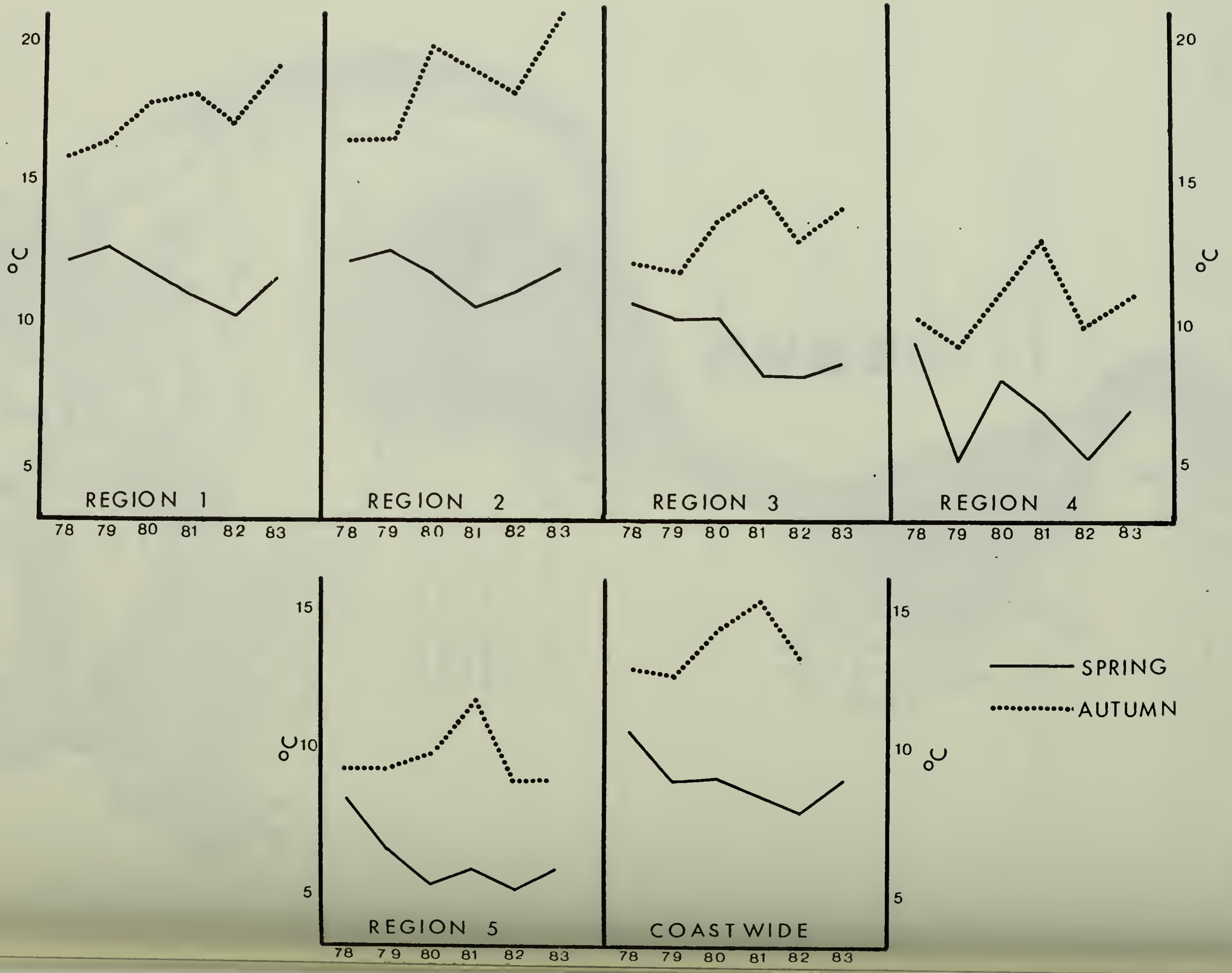

Table 1. Allotment of sampling effort to Massachusetts inshore strata, 1983 survey cruises.

	Stratum	Depth Range		Area	Number	Stations
Region	No.*	Meters	Feet	(sq n mi)	Spring	Autumn
1. Buzzards Bay Vineyard Sound and coastal water south of Martha's Vineyard	11	< 9.3	< 30	102	4	5
	12	9.4-18.3	31- 60	160	8	8
	13	18.4-27.4	61- 90	88	4	4
	14	27.5-36.6	91-120	16	2	2
2. Nantucket Sound	15	< 9.3	< 30	190	10	8
	16	9.4-18.3	31- 60	212	11	8
3. East of Cape Cod, Race Point to Muskeget Island	17	< 9.3	< 30	85	5	4
	18	9.4-18.3	31- 60	88	4	3
	19	18.4-27.4	61- 90	39	2	2
	20	27.5-36.6	91-120	24	2	2
	21	36.7-54.9	121-180	40	2	2
4. Cape Cod Bay	25	< 9.3	< 30	47	3	3
	26	9.4-18.3	31- 60	87	4	4
	27	18.4-27.4	61- 90	94	5	5
	28	27.5-36.6	91-120	93	5	5
	29	36.7-54.9	121-180	103	5	5
	30	>55.0	>181	32	2	2
5. Massachusetts Bay north to New Hampshire border	31	< 9.3	< 30	41	3	3
	32	9.4-18.3	31- 60	49	2	2
	33	18.4-27.4	61- 90	78	3	3
	34	27.5-36.6	91-120	38	2	2
	35	36.7-54.9	121-180	174	5	4
	36	>55.0	>181	33	3	3

* Sampling strata begin with #11 to coordinate with Rhode Island survey design. Strata #22-24 have been allotted to Nantucket Shoals should survey coverage be eventually extended seaward.

Table 2. Summary of 1983 Massachusetts Division of Marine Fisheries bottom trawl survey cruise effort and collections, Massachusetts territorial waters.

	Cruise 8391	Cruise 8392
Vessel	R/V GLORIA MICHELLE	R/V GLORIA MICHELLE
Date	9 May - 25 May	7 Sept. - 24 Sept.
Sampling days	17	17
Stations completed	96	90
Tows aborted	8	10
Mean tow distance and range (n mi)	0.78 (0.36*-0.98)	0.76 (0.34*-0.98)
Vessel hours	209	212
DMF participants	17	19
Scientific man-hrs at sea	642	623
Number species caught	63	91
Mean no. species/tow and range	16 (9-28)	17 (4-33)
Total catch weight (kg)	21,200.1	13,592.7
Total catch number	80,264	298,013
Collections completed:		
Age, growth and maturity samples	1,320	617
Age and growth specimens	451	267
Pathobiological observations	5,586	3,794
Special samples	1,839	1,081

* Denotes tow duration of less than 20 minutes

Table 3. Weight (kilograms) and number for species collected during the 1983 spring and autumn bottom trawl surveys, Massachusetts territorial waters.

	Spring		Autumn	
Species	Wt.	No.	Wt.	No.
Ocean pout	4,886.7	6,228	169.0	951
Northern searobin	4,289.6	25,543	69.3	1,404
Winter skate	2,526.8	1,739	1,486.8	1,106
Winter flounder	2,197.9	7,565	778.4	3,647
Little skate	1,001.4	1,709	944.3	1,885
Atlantic cod	867.9	2,686	4.7	77
Windowpane	704.3	2,299	92.5	470
Longhorn sculpin	538.1	3,534	63.9	794
American plaice	438.1	2,772	222.0	4,054
Tautog	435.6	251	24.5	90
Yellowtail flounder	397.2	1,227	164.8	1,076
Spider crab	364.4	4,595	69.4	1,047
Longfin squid	358.4	4,500	288.2	39,818
Spiny dogfish	316.7	81	4,891.3	1,816
Red hake	307.0	1,333	633.2	2,715
Silver hake	257.0	2,106	185.6	1,917
Scup	175.5	1,262	1,174.6	140,003
Summer flounder	117.5	115	83.0	71
Rock crab	93.9	738	456.3	5,782
Atlantic herring	84.6	2,106	63.5	743
Black sea bass	75.8	235	50.8	8,933
Sea raven	72.8	82	12.3	52
American lobster	70.0	208	350.9	1,364
Moonsnail (unclassified)	69.1	691	34.1	336
Goosefish	64.3	12	94.6	19
Smooth dogfish	60.1	18	297.9	409
Pollock	49.0	502	2.1	8
Fourspot flounder	48.0	243	58.7	359
Witch flounder	47.8	102	69.9	110
Alewife	40.7	1,350	18.6	176
Atlantic wolffish	39.8	17	6.2	2
Haddock	27.1	126	0.9	36
Knobbed whelk	22.7	50	98.0	201
Thorny skate	21.9	19	61.6	72
Cunner	17.1	147	3.0	116
American sand lance	15.2	2,030	0.0	3
Butterfish	11.7	113	229.4	20,809
Snakeblenny	11.7	183	9.5	257
Fourbeard rockling	10.2	190	11.3	119
Blueback herring	9.2	586	1.1	22
White hake	9.1	107	27.8	137
Horseshoe crab	7.9	8	24.9	24
Lady crab	7.5	82	74.5	1,958
Striped searobin	7.3	19	3.3	23

Table 3. (Continued)

	Spring		Autumn	
Species	Wt.	No.	Wt.	No.
Channeled whelk	5.2	16	14.8	64
Sea scallop	3.1	12	18.0	313
Daubed shanny	3.0	516	0.2	42
Jonah crab	2.6	20	43.4	220
Atlantic mackerel	2.3	3	-	-
Rainbow smelt	2.0	73	0.6	30
American shad	2.0	37	2.2	17
Mussel (unclassified)	1.5	8	17.3	51,233
Conger eel	1.3	1	-	-
Redfish	1.0	8	0.2	1
Bay scallop	0.5	10	10.5	121
Ocean quahog	0.4	2	0.3	2
Shortfin squid	0.2	1	3.4	21
Spotted hake	0.1	8	1.4	12
Alligatorfish	0.0	10	0.3	107
Rock gunnel	0.0	6	0.0	11
Northern pipefish	0.0	2	0.2	186
Atlantic tomcod	0.0	1	-	-
Mailed sculpin	0.0	1	0.0	1
Torpedo ray	-	-	50.0	2
Wrymouth	-	-	5.9	5
Bluefish	-	-	5.2	25
Surf clam	-	-	3.7	7
Mackerel scad	-	-	1.8	281
Hogchoker	-	-	1.2	11
Weakfish	-	-	0.8	48
Gray triggerfish	-	-	0.7	1
Northern stonecrab	-	-	0.6	1
Round herring	-	-	0.5	8
Menhaden	-	-	0.5	2
Northern puffer	-	-	0.4	88
Gulf Stream flounder	-	-	0.3	4
Fawn cusk eel	-	-	0.2	10
Octopus (unclassified)	-	-	0.2	3
Blue crab	-	-	0.2	2
Oyster toadfish	-	-	0.2	1
Bay anchovy	-	-	0.1	75
Striped anchovy	-	-	0.1	39
Atlantic moonfish	-	-	0.1	13
Atlantic silversides	-	-	0.1	3
Northern kingfish	-	-	0.1	1
Blue runner	-	-	0.1	1
Snowy grouper	-	-	0.0	8
Short bigeye	-	-	0.0	4
Lumpfish	-	-	0.0	3
Guaguanche	-	-	0.0	2
Radiated shanny	-	-	0.0	1
Planehead filefish	-	-	0.0	1
Seasnail	-	-	0.0	1
TOTAL	21,200.0	80,264	13,592.7	298,013

APPENDIX TABLE 1. Average bottom temperature (° C) by depth interval and region, Massachusetts inshore bottom trawl surveys, spring and autumn, 1983.

SPRING

Depth (m)

Region	< 9.3	9.4-18.3	18.4-27.4	27.5-36.6	36.7-54.9	>55.0	Mean	Range
1	11.8	11.6	11.6	10.0			11.5	8.5-13.0
2	12.4	11.3					11.8	9.5-14.2
3	9.2	9.5	9.0	5.5	6.5		8.4	5.5-11.0
4	7.2	8.9	7.0	6.2	6.5	5.0	6.9	4.5-11.0
5	6.0	6.2	6.2	5.4	6.0	5.0	5.8	4.7- 6.7

AUTUMN

Depth (m)

Region	< 9.3	9.4-18.3	18.4-27.4	27.5-36.6	36.7-54.9	>55.0	Mean	Range
1	20.3	19.5	18.4	16.6			18.9	15.5-21.9
2	20.9	20.5					20.7	19.7-21.6
3	16.0	16.6	14.0	9.5	8.5		13.9	8.3-20.7
4	15.0	14.9	10.8	9.2	9.0	8.3	10.9	7.6-16.8
5	*	*	*	*	*	*	*	*

*Instrument malfunction

APPENDIX TABLE 2. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of ALL SPECIES for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
		SPRING			
1978	176.01	112.91 - 239.11	833.07	492.91 -1173.23	0.21
1979	169.16	139.08 - 119.25	718.70	524.56 - 912.83	0.24
1980	161.70	113.80 - 209.61	1099.83	426.90 -1772.76	0.15
1981	258.11	214.64 - 301.58	1220.09	971.43 -1468.74	0.21
1982	244.09	151.65 - 336.53	2010.07	110.34 -3909.81	0.12
1983	221.71	167.05 - 276.37	849.05	520.92 -1177.19	0.26
		AUTUMN			
1978	315.38	135.23 - 495.53	3310.90	2279.92 -4341.88	0.10
1979	139.74	101.91 - 177.58	2029.87	1604.97 -2454.77	0.07
1980	120.04	90.12 - 149.96	2711.74	2019.01 -3404.48	0.04
1981	134.50	71.30 - 197.71	2517.17	507.91 -4526.42	0.05
1982	295.90	83.36 - 508.44	4201.31	2270.81- 6131.79	0.07
1983	135.24	84.819- 185.66	3303.79	1824.59- 4783.00	0.04

APPENDIX TABLE 3. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of ATLANTIC COD for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	5.63	3.66 - 7.59	45.67	21.34 - 70.00	0.12
1979	9.85	3.15 - 16.56	54.12	23.71 - 84.53	0.18
1980	9.08	6.07 - 12.10	39.63	27.33 - 51.94	0.23
1981	10.22	3.62 - 16.82	50.35	32.63 - 68.07	0.20
1982	7.42	4.17 - 10.67	22.10	14.46 - 29.75	0.34
1983	10.28	5.61 - 14.95	32.19	21.22 - 43.16	0.32
AUTUMN					
1978	1.47	* - 3.52	76.25	28.19 - 124.32	0.02
1979	0.50	0.06 - 0.94	4.04	1.67 - 6.41	0.12
1980	0.75	0.17 - 1.33	7.11	2.57 - 11.65	0.11
1981	3.06	* - 6.72	7.80	* - 15.66	0.39
1982	0.62	* - 1.70	3.72	0.24 - 7.19	0.17
1983	0.08	* - 0.19	1.03	0.34 - 1.72	0.08

* Negative lower limit.

APPENDIX TABLE 4.

ATLANTIC COD :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2			.230							
3	.489		2.574					.145	.497	.046
4	3.997	.239	5.446	.034	.178			.333	.984	.274
5	4.689	.573	6.804	.034	.311				.216	
6	1.265	.382	1.705	.127	.248				.035	.046
7	.070	.143	.212							
8		.048	.230							.027
9	.070									
10								.072		
11	.070								.045	
12					.126			.072	.048	.105
13					.109					
14					.781					.105
15					1.701					
16			.145		4.459					
17			.145		5.794					
18			.145	.041	5.807					
19			.290		7.333					.211
20			.942	.141	6.834					
21			.942	.606	7.894					.105
22			1.232	.424	8.298					.421
23			2.246	.422	5.803					.316
24			1.710	.368	4.378					
25			2.174	.469	3.970					
26			2.246	.225	1.887					.105
27			1.957	.281	1.334					
28			1.159	.090	1.170					
29			.725	.088	.843					.211
30			.652		1.050					
31			.290	.045	1.473					
32			.290	.122	.940					
33			.072	.045	1.151					
34			.290	.080	2.350					
35				.163	1.651					
36				.208	2.802					
37				.132	2.253					
38			.159	.332	2.153					
39				.414	2.047					
40			.145	.533	1.683					
41				.206	1.459					
42			.072	.328	1.639					
43			.072	.288	1.844					
44			.072	.123	1.847				.122	.211
45			.072	.246	.828					
46				.093	1.464					
47				.246	.541					
48			.072	.164	.512					

APPENDIX TABLE 4, CONT.

ATLANTIC COD :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49			.072	.202	.587					
50			.290	.298	.426					
51			.232		.066					
52			.145	.257	.268					.027
53			.159	.076	.269					
54				.089	.326					
55			.072	.110	.353					
56				.129	.420					
57					.249					
58				.041	.189					
59					.437					
60			.217		.613					
61			.043	.093	.084					
62			.072	.041	.084					
63					.084					
64			.072		.046					
65			.116		.053					
66										
67			.043		.099					
68				.122						
69				.045						
70										
71				.041						
72										
73										
74				.041						
75										
76										
77			.043							
78										
79										
80										
81										
82										
83										
84										
85										
86					.084					
87										
88										
89										
90										
91										
92										
93										
94										
95										
96										

APPENDIX TABLE 4. CONT. ATLANTIC COD :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
97										
98					.084					
99										
100				.041	.084					
101										
102										
103										
104										
105										
106					.027					
TOTAL:	10.649	1.385	37.100	8.747	103.877			0.623	1.947	2.209
AVE.LN:	4.73	5.41	17.10	36.62	27.41			5.40	6.76	21.14

APPENDIX TABLE 5. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of HADDOCK for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	0.27	0.02 - 0.53	0.46	0.04 - 0.87	0.60
1979	0.02	* - 0.04	0.12	* - 0.28	0.15
1980	0.27	0.11 - 0.44	2.12	0.75 - 3.49	0.13
1981	0.25	0.07 - 0.43	1.94	0.59 - 3.29	0.13
1982	0.02	* - 0.05	0.03	* - 0.06	0.69
1983	0.34	0.06 - 0.63	1.70	0.82 - 2.58	0.20
			AUTUMN		
1978	0.00	0.00	0.01	* - 0.02	0.00
1979	0.06	0.04 - 0.08	7.19	4.43 - 9.94	0.01
1980	0.16	0.05 - 0.28	7.83	2.56 -13.09	0.02
1981	0.14	* - 0.33	0.52	* - 1.11	0.27
1982	0.11	0.01 - 0.21	13.38	0.03 -26.72	0.01
1983	0.01	* - 0.02	0.40	* - 0.82	0.02

* Negative lower limit.

APPENDIX TABLE 6. HADDOCK :

Stratified mean number per tow (untransformed) by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5			.043							
6										
7										.046
8										
9										
10										.197
11								.145		.184
12								.580		.289
13								.290		.046
14								.217		
15								.072		
16					.253					
17					.261			.072		.105
18					.268					
19					.651					
20					.433					
21			.290		.967					.027
22			.261		1.272					
23			.507	.045	1.153					.027
24			.290	.045	.532					
25			.217		.138					
26			.145		.084					
27					.084					
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43					.084					
44										
45										
46										
47										
48										

APPENDIX TABLE 6, CONT.

HADDOCK :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49					.169					
50										
51					.169					
52										
53										
54										
55										
56										
57										
58			.043							
59			.043							
60			.043							
TOTAL:			1.884	0.090	6.517			1.377		0.921
AVE.LN:			25.25	23.50	23.06			12.84		12.32

APPENDIX TABLE 7. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of SILVER HAKE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.63	0.24 - 1.02	4.85	2.70 - 7.00	0.13
1979	1.89	* - 3.92	7.72	3.02 - 12.41	0.24
1980	1.54	* 3.13	10.65	3.63 - 17.67	0.14
1981	1.76	0.60 - 2.93	15.34	5.89 - 24.79	0.12
1982	0.31	0.17 - 0.45	3.47	2.20 - 4.74	0.09
1983	2.41	1.26 - 3.55	20.38	8.98 - 31.77	0.12
			AUTUMN		
1978	1.86	0.75 - 2.98	45.38	19.16 - 71.60	0.04
1979	3.11	2.16 - 4.05	41.74	32.93 - 50.55	0.07
1980	3.27	0.81 - 5.74	34.62	17.56 - 51.69	0.09
1981	3.61	2.41 - 4.82	27.60	18.69 - 36.51	0.13
1982	1.95	1.46 - 2.43	42.42	28.57 - 56.28	0.05
1983	1.82	1.46 - 2.19	20.93	16.64 - 25.22	0.09

* Negative lower limit.

APPENDIX TABLE 8.

SILVER HAKE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2									.035	
3				.041					.035	
4									.041	
5				.034					.293	
6					.084	.056			.722	
7				.045					.232	
8	.437			.048	.217				.163	
9	.077	.048	.071	.247	.084					
10	.131		.072	.540	.390					.211
11	.230		.071	.410	.053				.086	.636
12	2.071			.966	.248				.118	1.544
13	3.306		.123	.635	.279			.217	1.137	2.817
14	7.443		.114	.592	.333			.217	1.676	3.596
15	4.765		.185	.981	.111			.652	2.277	4.230
16	1.710		.071	1.260	.325			.870	2.544	3.299
17	1.541		.141	.921	.528			.435	2.090	3.793
18	2.973			1.597	.747	.022		.942	2.239	4.142
19	2.596			1.142	.631	.022		1.014	1.755	2.058
20	1.623		.141	.864	.612	.087		1.464	2.520	3.961
21	.262		.072	.472	.090	.044		1.522	1.396	3.804
22	1.208		.261	.735	.111	.022		1.159	2.012	2.207
23	2.410		.288	.430	.527	.109		.507	1.976	2.508
24	2.601		.406	1.271	.796			.507	2.250	.794
25	1.776		.864	1.895	.857			.072	1.404	.292
26	2.011		1.288	2.308	1.102			.072	2.070	.266
27	2.120		1.127	2.655	.237				2.039	.478
28	1.798		.694	2.229	.321			.072	1.886	.690
29	1.519		.661	2.279	.126			.072	2.189	.450
30	1.503		.839	1.042	.271				1.764	.370
31	1.557		.145	.842					1.054	.133
32	.913		.214	.551	.080				1.114	.213
33	.732		.114	.510	.027				1.091	.186
34	.546		.143	.258	.027				.206	.133
35	.328		.072	.480					.302	.080
36	.896			.229	.084				.347	.107
37	.213			.222					.080	.053
38	.044			.207	.126				.341	
39	.131			.258	.027				.090	.132
40	.087			.131	.027				.171	.107
41	.344			.128	.053				.125	.027
42	.066			.086	.027				.035	.027
43	.082			.132						
44				.035					.090	
45				.080					.035	.027
46				.131						.080
47	.060								.080	
48										

APPENDIX TABLE 8, CONT.

SILVER HAKE :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49				.041						
50									.035	
51				.048						
52									.045	
53										
54										
55										
56										
57										
58									.045	
TOTAL:	52.109	0.048	8.178	30.005	9.558	0.362		9.797	42.237	43.451
AVE.LN:	20.90	9.00	25.67	24.02	21.20	18.81		19.56	22.58	18.66

APPENDIX TABLE 9. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of RED HAKE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	3.40	* - 7.70	11.12	* - 26.00	0.31
1979	11.85	* -27.02	33.71	* - 74.54	0.35
1980	3.03	1.24 - 4.81	16.00	2.62 - 29.38	0.19
1981	12.01	* -28.46	34.77	2.06 - 67.48	0.34
1982	2.86	* - 5.80	7.30	1.26 - 13.34	0.39
1983	3.16	1.51 - 4.82	14.46	7.17 - 21.74	0.22

AUTUMN

1978	2.57	1.83 - 3.31	8.31	5.47 - 11.14	0.31
1979	2.75	1.84 - 3.66	12.77	6.66 - 18.88	0.22
1980	3.44	1.77 - 5.10	18.09	7.44 - 28.73	0.19
1981	6.12	3.68 - 8.57	32.87	19.93 - 45.80	0.19
1982	3.42	2.32 - 4.51	17.95	12.84 - 23.06	0.19
1983	5.68	3.22 - 8.14	26.85	13.78 - 39.93	0.21

* Negative lower limit.

APPENDIX TABLE 10.

RED HAKE :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

REGIONS

	SPRING					AUTUMN				
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5			.062							
6			.062						.286	
7									.095	
8										
9										
10				.095					.048	
11				.048						
12				.609					.041	
13		.048		.883	.357				.041	.138
14	.224	.048		.546	.421					.046
15	.224			.422	.195			.870		.467
16	.770			1.295	.843			1.884	.082	.748
17	.689		.087	2.015	.927			3.913	.210	1.965
18	.732			1.986	1.011			4.058	.418	2.070
19	.470		.072	1.370	.585			3.986	.822	2.241
20	.328		.072	1.300	.653			5.507	1.908	3.163
21	1.016			.737	.559			2.609	3.214	1.524
22	.951			.520	.467			1.739	3.872	1.567
23	2.273			.550	.130			.870	4.135	.379
24	1.486			.304	.169			.435	4.137	.827
25	2.874			.090	.147	.022		.435	3.561	.800
26	.907			.221	.084	.022			2.220	.791
27	.973			.226	.248				2.134	.424
28	.175			.121	.147				1.793	.370
29	.803		.072	.586	.299				1.976	.554
30	.180		.145	.620	.084				2.405	.580
31	.443		.072	.823	.169				2.807	.610
32	1.448		.072	.824	.147				3.835	.719
33	1.448			.728	.812				3.587	1.005
34	1.448		.145	.671	.448				2.939	1.409
35	1.694		.290	.776	.342				3.472	1.196
36	1.776		.145	.349	.222				2.255	1.592
37	1.109		.072	.839	.405				2.403	1.747
38	1.000		.043	.596	.302				1.800	.798
39	1.027	.096	.072	.505					2.208	1.145
40	.164		.071	.848	.138				1.673	.906
41	.301			.747	.027				1.179	.426
42	.683			.936	.169				.808	.638
43	.164	.048		.447	.111				1.211	.264
44	.563			.503					.634	.453
45	.120		.072	.389	.073				.467	.345
46	.060			.173					.411	.213
47	.180	.048		.374	.046				.557	
48				.210					.211	.212

APPENDIX TABLE 10, CONT.

RED HAKE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49				.134	.046				.482	.053
50				.124	.084				.246	.053
51				.293					.146	.053
52				.164	.046				.035	
53	.022			.175					.035	
54				.168					.041	
55				.041					.076	
56				.041					.125	.053
57										.053
58										
59										
60									.041	
61				.041						.053
62									.041	
TOTAL:	28.727	0.288	1.629	26.460	10.913	0.044		26.304	67.127	32.653
AVE.LN:	29.29	32.50	30.41	28.29	25.03	25.50		19.12	30.48	28.03

APPENDIX TABLE 11. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of WHITE HAKE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.95	* - 2.23	4.23	0.34 - 8.12	0.22
1979	0.34	* - 0.77	2.23	0.82 - 3.65	0.15
1980	0.12	0.04 - 0.20	2.29	0.54 - 4.04	0.05
1981	0.28	0.12 - 0.44	4.79	2.69 - 6.89	0.06
1982	0.03	0.01 - 0.06	0.44	0.13 - 0.74	0.07
1983	0.12	0.01 - 0.22	1.33	0.53 - 2.13	0.09

AUTUMN

1978	0.80	0.55 - 1.05	13.72	9.68 - 17.76	0.06
1979	0.78	0.44 - 1.12	7.25	4.42 - 10.09	0.11
1980	1.01	0.71 - 1.31	12.91	9.40 - 16.43	0.08
1981	0.97	0.54 - 1.40	10.34	5.04 - 15.64	0.09
1982	0.60	0.30 - 0.90	5.48	2.42 - 8.54	0.11
1983	0.32	0.20 - 0.45	1.82	1.17 - 2.47	0.18

* Negative lower limit.

APPENDIX TABLE 12. WHITE HAKE :

Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3	.497									
4	1.015									
5	.428								.095	
6	.070								.048	
7	.070		.071							
8										
9										
10										
11								.077		
12	.055					.056		.077		
13				.045	.084			.077		
14					.084					
15	.219									.105
16					.084	.056		.077		.105
17	.055				.084	.111			.090	.105
18						.056				.105
19				.086	.169					.421
20				.090	.084				.090	.274
21				.045	.285				.041	.316
22				.086	.436				.045	.527
23				.177	.258				.045	.168
24	.055			.181	.364				.181	.421
25				.045	.475				.041	.316
26				.080	.111				.035	.316
27									.090	.027
28					.084				.176	.105
29					.053	.060			.347	.027
30					.111				.479	.105
31					.053				.768	
32				.041					.383	
33									.312	
34									.181	
35									.166	.105
36					.084				.181	
37									.035	
38				.045					.035	
39									.045	
40									.045	
TOTAL:	2.462		0.071	0.922	2.904	0.339		0.308	3.956	3.550
AVE.LN:	6.00		7.00	23.34	23.02	18.31		13.00	29.35	22.55

APPENDIX TABLE 13. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of SCUP for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	17.81	* - 46.30	50.48	* -123.22	0.35
1979	9.63	0.25 - 19.00	40.65	3.44 - 77.86	0.24
1980	22.95	* - 65.18	104.74	* -284.58	0.22
1981	9.48	2.28 - 16.67	159.41	27.72 -291.10	0.10
1982	0.53	0.01 - 1.04	5.66	0.04 - 11.27	0.09
1983	1.80	0.29 - 3.30	12.98	1.23 - 24.74	0.14

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	14.26	9.42 - 19.11	1797.25	1026.82-2567.68	0.01
1979	11.38	7.92 - 14.84	1088.63	746.06-1431.21	0.01
1980	12.08	8.77 - 15.39	1141.45	792.69-1490.21	0.01
1981	13.51	6.42 - 20.60	911.16	258.59-1563.73	0.02
1982	8.61	4.63 - 12.59	2012.63	630.46-3394.80	< 0.01
1983	13.98	6.09 - 21.86	1669.54	765.55-2573.52	0.01

* Negative lower limit.

APPENDIX TABLE 14.

SCUP :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3						10.723				
4						224.896	9.374			
5						1176.031	335.913	22.878		
6						1301.726	1310.410	39.994	.041	
7						489.728	1637.485	10.289		
8						245.181	877.961	29.316		
9						68.153	299.968	41.361		
10	.464					2.257	39.552	9.167		
11	.842					1.240	.316			
12	.295					11.783				
13						15.658	.900			
14						32.022	8.412	.877		
15	1.038	.190				13.255	7.888	3.746		
16	6.262	1.381	.071			3.145	1.302	5.181		
17	12.907	4.088	.424			.110	.066	1.435		
18	12.643	4.132	.353			.278				
19	5.749	4.230	.212			2.505	.650			
20	1.333	2.276	.071			5.614	.945	.159		
21	.825	2.082				5.955	.118			
22	.109	1.235	.071			2.666				
23	.092	.949				2.383	.118			
24	.124	.901				3.603				
25		.473				1.878				
26						1.714				
27	.070	.047				.773				
28		.048				.663	.236			
29						.279				
30						.164				
31							.118			
32						.111				
33										
34										
35						.055				
36						.109				
37										
38										
39										
40										
41										
42										
43										
44							.118			
TOTAL:	42.754	22.033	1.201			3624.657	4531.853	164.402	0.041	
AVE.LN:	17.37	19.22	18.06			6.17	6.95	7.93	6.00	

APPENDIX TABLE 15. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of BLACK SEA BASS for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	0.37	* - 0.77	1.12	* - 2.82	0.33
1979	0.40	0.10 - 0.69	0.54	0.17 - 0.91	0.74
1980	0.43	0.13 - 0.73	0.54	0.16 - 0.93	0.79
1981	0.71	0.32 - 1.11	1.19	0.52 - 1.86	0.60
1982	0.49	0.27 - 0.71	1.18	0.59 - 1.77	0.42
1983	0.76	0.21 - 1.30	2.35	0.56 - 4.14	0.32
			AUTUMN		
1978	0.48	0.18 - 0.78	43.77	* -95.96	0.01
1979	0.61	0.32 - 0.91	40.71	1.33 -80.09	0.02
1980	0.55	0.24 - 0.85	52.37	18.53 -86.22	0.01
1981	0.17	0.08 - 0.26	34.86	6.99 -62.74	0.01
1982	0.81	0.47 - 1.15	217.34	69.44-365.23	> 0.01
1983	0.64	0.16 - 1.12	117.50	* -246.44	0.01

* Negative lower limit.

APPENDIX TABLE 16.

BLACK SEA BASS :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3						5.295				
4						16.745	22.493	.462		
5						33.361	98.464	1.324		
6						12.118	167.827	2.421		
7						3.234	155.966	1.524		
8						.165	43.154	.071		
9							.461			
10										
11										
12		.048								
13										
14										
15										
16										
17										
18										
19		.047								
20	.273	.095								
21	.077	.143				.111				
22	.109	.474	.132							
23	.328	.995								
24	.169	1.756	.150		.046	.111				
25	.109	1.141	.274			.223				
26	.169	1.280	.062							
27	.109	.332				.166	.059			
28	.060	.426	.071			.223				
29	.109	.095				.385	.118			
30	.022	.190				.278	.125			
31		.142				.223				
32	.164	.379	.071							
33	.109	.142					.177			
34		.189								
35	.055	.332								
36		.237						.080		
37		.047								
38	.109							.080		
39		.095								
40										
41										
42										
43		.048	.071							
44										
45		.096								
46										
47	.055									
48										

APPENDIX TABLE 16, CONT.

BLACK SEA BASS :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49 ‖	!	!	!	!	‖	!	.066!	!	!	
TOTAL:	2.027	8.728	0.830		0.046	72.638	488.910	5.961		
AVE.LN:	26.72	26.65	26.80		24.00	5.42	6.23	6.73		

APPENDIX TABLE 17. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of TAUTOG for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	4.48	0.88 - 8.09	2.36	0.55 - 4.17	1.90
1979	5.16	1.54 - 8.78	2.89	1.02 - 4.77	1.78
1980	4.13	1.25 - 7.01	1.91	0.64 - 3.18	2.17
1981	2.86	1.38 - 4.34	2.16	1.00 - 3.31	1.33
1982	5.94	1.86 -10.01	3.70	1.04 - 6.36	1.60
1983	5.24	1.18 - 9.30	2.96	0.79 - 5.14	1.77

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.72	0.05 - 1.39	0.46	0.06 - 0.87	1.56
1979	0.57	0.19 - 0.95	1.57	* - 3.24	0.36
1980	1.05	0.24 - 1.86	4.50	* - 9.95	0.23
1981	0.79	0.12 - 1.47	0.96	0.36 - 1.56	0.83
1982	0.70	* - 1.52	0.65	0.14 - 1.16	1.07
1983	0.27	0.04 - 0.49	0.99	0.16 - 1.82	0.27

* Negative lower limit.

APPENDIX TABLE 18.

TAUTOG :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5									.206	
6								.231	.069	
7								.154	.164	
8										
9										
10										
11							.118			
12							.118			
13						.111	.236			
14		.047					.414		.048	
15		.047				.111	.414			
16						.109				
17		.048					.118		.095	
18	.249						.177			
19	.139	.047							.095	
20	.055	.142				.109	.059		.034	
21	.070	.047								
22	.055	.142								
23						.109				
24		.142				.055	.059			
25	.109	.047				.275				
26	.055	.047								
27		.095					.118			
28		.144				.223				
29		.095				.332				
30	.070	.047	.062			.109				
31	.279	.238								
32	.124	.048								
33	.403	.048				.109				
34	.194	.047								
35	.055	.095								
36	.124	.189				.109				
37	.209	.284								
38	.055	.047								
39	.542									
40	.706	.095								
41	.891	.048								
42	.443	.190								
43	.751	.142								
44	.279	.047								
45	.941	.142		.048						
46	.512	.047								
47	.458	.142								
48	.751	.047								

APPENDIX TABLE 18, CONT.

TAUTOG :
Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
					REGIONS					
CMS	1	2	3	4	5	1	2	3	4	5
49	.264									
50	.836	.047								
51	.264	.236				.060				
52	.209									
53	.279									
54	.348									
55	.264	.189				.109				
56		.047								
57										
58	.070	.047				.055				
59	.070			.069						
60		.047								
61	.124	.047								
TOTAL:	11.245	3.695	0.062	0.116		1.988	1.831	0.385	0.712	
AVE.LN:	42.80	36.92	30.00	53.26		28.53	15.71	6.40	10.37	

APPENDIX TABLE 19. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of OCEAN POUT for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	21.10	8.72 - 33.48	45.88	25.01 - 66.74	0.46
1979	22.82	15.88 - 29.76	44.80	29.93 - 59.68	0.51
1980	16.13	10.43 - 21.84	28.70	17.87 - 39.54	0.56
1981	35.04	24.58 - 45.50	62.43	42.12 - 82.73	0.56
1982	35.29	20.02 - 50.56	51.18	32.17 - 70.18	0.69
1983	49.36	33.42 - 65.30	65.30	46.49 - 84.11	0.76

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	1.48	0.88 - 2.08	18.66	10.08 - 27.23	0.08
1979	2.15	1.35 - 2.95	25.05	14.97 - 35.14	0.09
1980	1.92	0.64 - 3.21	13.94	4.76 - 23.12	0.14
1981	1.91	0.77 - 3.06	6.67	3.05 - 10.28	0.29
1982	3.51	1.42 - 5.60	20.43	8.99 - 31.86	0.17
1983	2.14	1.04 - 3.25	12.52	4.94 - 20.10	0.17

APPENDIX TABLE 20.

OCEAN POUT :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
					REGIONS					
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7				.082						.211
8				.048						.948
9				.048						1.159
10								.362		1.580
11								.217		.975
12								.217	.045	.527
13									.082	
14									.089	
15				.408	.253				.406	
16				.181	.390				.164	.527
17				.552				.072	.041	.421
18				.338	.299				.090	.843
19				.430	.506			.362		2.107
20				.395	.179			.217	.105	3.403
21			.072	.758	.506			.217	.204	2.713
22				.459	.084			.362	.162	1.488
23				.424	1.128				.331	.741
24				.493	1.344			.217	.125	.843
25	.087		.072	.764	.884				.201	1.133
26				1.095	1.352			.217	.467	.915
27			.072	1.532	3.087			.217	.331	1.923
28	.087			1.494	4.052			.072	.738	.685
29	.148			1.185	2.827			.072	.604	1.179
30	.087		.072	.986	2.253			.072	.347	.765
31	.060		.145	.940	2.579			.290	.512	.896
32			.145	1.517	2.229			.217	.718	.212
33	.087			1.690	2.173			.072	.251	.764
34	.208		.072	1.476	3.350			.217	.612	1.238
35				2.054	2.498				.386	.869
36	.153		.072	1.875	2.769				.875	.817
37	.514		.145	2.508	2.264				.995	.869
38	.333		.072	1.845	1.749				.793	.843
39	.202		.072	2.029	.995			.072	.447	.211
40	.628			2.023	1.719				.672	.369
41	.454		.217	2.087	2.993				.633	.475
42	.541			2.444	2.122				.457	.423
43	.781			1.974	2.609				.557	.369
44	.634		.043	3.693	2.222				.457	.237
45	.989			2.668	2.762				.407	.027
46	1.290			4.228	2.132			.217	.532	.237
47	.508			2.591	2.087				.331	.027
48	.836			3.015	3.616				.432	.800

APPENDIX TABLE 20, CONT.

OCEAN POUT :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49	.929		.087	3.786	5.071				.296	.764
50	1.049		.188	3.924	4.019				.161	
51	.574			2.591	5.928				.161	.237
52	.574		.072	2.688	5.354				.283	.237
53	.393		.303	3.521	7.430				.196	.090
54	.514		.288	3.555	5.492				.125	.237
55	.153		.043	2.808	5.665				.161	.211
56	.426		.480	2.224	6.469				.080	
57	.022		.290	2.733	5.442				.090	.211
58	.240		.216	3.762	6.004				.090	
59			.361	4.321	3.878				.035	
60			.377	3.686	3.218				.045	.237
61			.261	4.353	4.896				.080	
62	.087		.453	2.571	2.812					
63	.022		.188	3.552	3.206					
64			.348	2.360	.970					
65			.375	3.348	1.653					
66			.159	3.461	2.302					
67			.370	1.764	1.257					
68	.022		.288	1.579	1.123				.035	
69			.152	1.602	.655				.045	
70			.216	2.436	.265				.035	
71			.145	.417	.437				.045	
72			.043	1.128	.109					
73			.143	.919					.045	
74			.152	.377	.264					
75			.145	.965	.046					
76				.724	.046					
77				.251						
78				.635	.126					
79				.082						
80				.289						
81				.271	.046					
82				.048	.046					
83				.128						
84				.247						
85				.143						
86				.082						
87										
88				.041						
89				.086						
90										
91										
92										
93				.045						
94				.247						
TOTAL:	13.634		7.418	126.077	146.242			3.986	16.608	36.990
AVE.LN:	45.89		57.10	50.82	47.72			23.89	36.85	26.49

APPENDIX TABLE 21. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of NORTHERN SEAROBIN for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	14.74	* - 41.02	75.95	* -214.10	0.19
1979	11.81	1.40 - 22.21	64.01	6.81-121.21	0.18
1980	12.53	0.61 - 24.43	55.37	2.82-107.92	0.23
1981	29.04	1.57 - 56.50	150.94	15.39-286.49	0.19
1982	59.39	* -135.31	329.24	* -749.18	0.18
1983	42.99	* - 92.44	256.16	* 567.45	0.17
AUTUMN					
1978	3.81	* - 9.12	21.56	2.24- 40.88	0.18
1979	4.20	* - 8.94	34.57	12.94- 56.19	0.12
1980	0.97	* - 1.43	19.35	10.99- 27.71	0.05
1981	0.70	0.07 - 1.33	23.40	* - 47.70	0.03
1982	1.29	0.25 - 2.32	33.12	6.61- 59.64	0.04
1983	0.84	0.21 - 1.47	17.83	5.41- 30.24	0.05

* Negative lower limit.

APPENDIX TABLE 22.

NORTHERN SEAROBIN :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4						.056		.154		
5						.056	3.030	.616	.048	
6						1.400	9.404	1.155		
7						1.059	14.950	2.312	.095	
8						2.557	15.201	2.120	.048	
9						1.084	7.790	.456	.191	
10	.055						2.700		.668	
11	.169		.239				1.055		1.097	
12		.048	.319						.382	
13	.109		.141						.095	
14	.055									
15										
16										
17	.115						.059			
18	.736	9.536								
19	.612	14.646	.529							
20	.671	38.891	1.183	.076			.066			
21	1.150	119.898	1.239	.156						
22	1.152	198.869	1.009	.082			.066	.638	.048	
23	.755	220.880	1.254	.335			.375	1.514		
24	.469	131.922	.973	.254		.022	.711	2.312	.471	.059
25	.383	105.055	.812	.095		.060	1.152	3.188	.273	.105
26	.270	167.201	.547	.082		.060	1.021	2.152	.184	.033
27	.164	111.123	.627	.220		.132	1.170	1.036	.165	.033
28	.249	45.732	.705	.122		.222	.684	.797		
29	.164	11.079	.563			.192	.514	.159	.048	
30	.109	10.413	.185			.167	.354	.159		
31	.055	7.769					.118		.045	
32		9.001					.066			
33		1.088				.116	.066			
34		.192				.056	.198			
35										
36		.096								
37	.109									
TOTAL:	7.551	1203.440	10.324	1.423		7.239	60.750	18.768	3.857	0.231
AVE.LN:	21.81	23.96	22.81	24.10		10.53	9.59	18.52	15.24	25.17

APPENDIX TABLE 23. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of LONGHORN SCULPIN for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	2.30	1.55 - 3.04	11.93	7.86 - 15.99	0.19
1979	2.63	1.79 - 3.48	17.91	10.04 - 25.78	0.15
1980	1.89	1.43 - 2.35	12.10	8.64 - 15.56	0.16
1981	6.08	4.00 - 8.15	38.67	23.88 - 53.47	0.16
1982	5.69	4.38 - 7.00	36.83	25.53 - 48.12	0.16
1983	6.08	4.04 - 8.13	44.69	19.40 - 69.97	0.14

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.26	0.12 - 0.41	4.09	1.43 - 6.74	0.06
1979	1.08	0.61 - 1.54	10.03	5.57 - 14.49	0.11
1980	1.21	0.49 - 1.92	14.49	5.99 - 23.00	0.08
1981	0.70	0.33 - 1.06	4.64	2.15 - 7.13	0.15
1982	1.38	0.71 - 2.04	14.83	6.66 - 23.00	0.09
1983	0.95	0.22 - 1.68	12.04	4.82 - 19.27	0.08

* Negative lower limit.

APPENDIX TABLE 24.

LONGHORN SCULPIN :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4						.111			.048	
5										
6										
7						.055				
8									.048	
9				.090		.022			.048	.211
10				.132	.727					1.869
11				.035	1.517			.145		2.785
12			.071	.221	1.738			.145	.086	3.903
13				.181	.858			.362	.035	4.363
14			.246	.171	2.704			.435	.408	3.593
15				.226	1.896			.725	.695	1.994
16			.290	.217	6.596			1.522	1.150	1.093
17				.352	10.322			.580	.822	.625
18				.559	18.992			1.087	.618	1.310
19			.043	.828	14.533			.797	.246	2.294
20			.362	1.786	14.972			.290	.510	2.883
21	.044		1.652	2.282	10.779			.072	.366	5.351
22	.044	.048	1.868	2.485	9.159			.145	.791	1.837
23	.208		2.679	1.544	10.009			.217	.696	3.203
24	.339		1.774	1.434	9.627			.072	.561	1.823
25	.410	.048	2.067	1.829	14.057			.072	.290	1.262
26	.568	.048	1.542	1.437	11.069				.290	.692
27	1.475	.048	1.299	1.213	10.853			.217	.086	.764
28	1.501	.287	2.348	1.417	5.810				.121	.421
29	1.010	.239	1.784	1.401	2.401					
30	.492	.144	1.344	1.206	2.166					
31	.131	.096	.370	.873	.431					
32	.164	.144	.174	.292						
33	.060		.114	.158	.283					
34				.093	.331					
35				.048						
36				.076						
37				.048						
TOTAL:	6.445	1.101	20.027	22.632	161.828	0.188		6.884	7.915	42.276
AVE.LN:	27.46	28.74	25.09	23.86	21.46	5.45		17.26	19.21	17.51

APPENDIX TABLE 25. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of YELLOWTAIL FLOUNDER for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	6.09	3.62 - 8.56	22.83	12.55 - 33.11	0.27
1979	6.90	4.93 - 8.86	26.42	18.87 - 33.96	0.26
1980	6.01	4.54 - 7.48	19.70	14.55 - 24.85	0.30
1981	9.81	7.34 - 12.27	46.52	31.12 - 61.93	0.21
1982	7.72	5.03 - 10.42	23.71	16.12 - 31.30	0.33
1983	5.45	2.95 - 7.95	16.11	10.10 - 22.11	0.34

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	1.68	0.91 - 2.46	9.95	6.72 - 13.17	0.17
1979	4.47	2.86 - 6.08	29.27	17.92 - 40.63	0.15
1980	3.55	2.42 - 4.67	24.75	16.66 - 32.83	0.14
1981	1.65	0.70 - 2.60	6.83	4.15 - 9.52	0.24
1982	2.52	1.62 - 3.42	13.11	7.23 - 18.99	0.19
1983	2.07	0.79 - 3.34	13.70	4.39 - 23.01	0.15

APPENDIX TABLE 26. YELLOWTAIL FLOUNDER :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2									.048	
3									.048	
4										
5										.033
6										
7										
8					.169					
9										
10				.048						
11					.189					
12		.048	.072	.095	.066					.316
13			.072	.225	.421			.072	.082	.218
14			.072	.334	.126					1.040
15			.072	.263	.172			.145	.247	1.643
16				.123	.109			.261	.289	3.346
17			.435	.041	.185			.406	.864	2.570
18			.232	.208	.551			.580	.827	1.619
19			.143	.215	.084			1.275	.985	1.559
20			.217		.084			1.531	1.277	1.186
21			.507	.258	.769			1.377	1.484	.862
22	.060		.478	.176	1.109			.980	1.199	.706
23			.293	.216	2.480			.879	.954	.782
24			.563	.656	3.994			1.212	.508	1.524
25			.438	.489	3.346			.734	.302	2.028
26	.022		.464	.612	5.057			.855	.497	2.206
27	.022		.553	.600	3.579			.995	.345	2.209
28			.123	.724	3.415			.609	.293	4.231
29	.044		.507	.436	3.535			.217	.253	4.172
30	.104		.567	.538	1.641			.391	.563	2.733
31	.082		.319	.365	.963				.132	1.430
32	.148		.207	.212	1.535			.072	.581	1.046
33	.087		.178	.123	1.948			.284	.257	.627
34	.066		.228		1.843			.130	.257	.656
35	.109		.486	.461	2.245				.296	.800
36	.109		.868	.165	3.071				.171	.046
37	.104		.426	.241	3.125					.293
38	.044		.299	.310	2.289			.116	.076	.197
39	.022		.062	.387	1.724				.045	.218
40	.022		.264	.172	1.563					
41	.022		.221	.121	1.831			.072		.063
42			.043	.035	1.518					.027
43				.045	1.084					
44			.043		.889					.027
45					.130					
46					.119					
47					.172					
48										

APPENDIX TABLE 26, CONT. YELLOWTAIL FLOUNDER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49					.253					
50										
51					.084					
TOTAL:	1.066	0.048	9.455	8.894	57.466			13.194	12.877	40.414
AVE.LN:	32.96	12.00	28.38	27.25	30.85			23.14	23.17	24.38

APPENDIX TABLE 27. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of WINTER FLOUNDER for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	18.70	12.80 - 24.60	62.74	47.50 - 77.97	0.30
1979	16.56	11.13 - 21.98	58.85	42.36 - 75.34	0.28
1980	16.23	11.93 - 20.54	51.34	41.47 - 61.21	0.32
1981	21.50	13.51 - 29.48	70.86	49.53 - 92.18	0.30
1982	14.76	9.78 - 19.74	49.54	34.50 - 64.58	0.30
1983	23.56	17.37 - 29.75	81.76	61.12 - 102.41	0.29
			AUTUMN		
1978	5.46	3.47 - 7.46	25.47	15.82 - 35.13	0.21
1979	13.68	9.13 - 18.22	54.26	36.95 - 71.58	0.25
1980	6.92	4.47 - 9.37	30.74	20.84 - 40.64	0.23
1981	6.36	4.39 - 8.33	22.51	15.37 - 29.66	0.28
1982	13.09	7.82 - 18.36	55.56	34.76 - 76.36	0.24
1983	8.61	5.33 - 11.88	44.69	17.23 - 72.15	0.19

APPENDIX TABLE 28.

WINTER FLOUNDER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

R E G I O N S

	SPRING					AUTUMN				
CMS	1	2	3	4	5	1	2	3	4	5
1										
2				.045						
3				.045						
4				.045						
5										
6				.103						
7				.034						
8				.314						
9				1.285	.084	.056				
10	.124	.142		2.789	.119	.055				
11	.216	.238		4.072	.701	.111				
12	.092	.334		6.267	.675					
13	.857	.570	.071	6.028	1.787	.111		.072	.872	.942
14	2.280	.476	.230	3.575	2.233	.056			2.402	2.121
15	1.485	.905	.203	3.790	2.699	.111		.217	4.300	3.982
16	3.730	.621	.264	2.124	2.761	.519		.507	6.819	5.328
17	2.939	.619	.274	1.719	2.511	.807		.217	7.480	7.882
18	4.049	.663	.344	1.624	5.165	.837		.290	6.600	9.936
19	3.120	.666	.388	1.626	4.391	1.420		.367	5.487	7.881
20	3.534	.955	.351	1.086	5.093	.459		.290	4.696	14.960
21	8.507	.622	.353	1.980	9.885	.925	.066	.523	2.140	7.997
22	6.652	.428	.433	3.732	8.231	.732		.284	1.689	5.878
23	5.520	.810	.274	3.655	9.662	.814		.662	.977	6.999
24	4.755	.522	.310	3.859	9.594	.396		.277	1.660	4.331
25	4.085	.810	.504	4.002	8.570	.487		.232	1.008	3.764
26	5.168	1.240	.900	4.027	5.580	.230		.563	2.727	4.461
27	4.138	.666	1.176	4.077	4.766	.202		.273	3.138	3.093
28	4.693	.714	.723	3.078	5.082	.290	.066	.731	2.738	1.617
29	4.705	1.334	1.621	3.192	7.322	.220		1.541	3.288	2.056
30	4.717	1.529	2.011	3.254	4.818	.191		1.250	2.318	2.062
31	6.007	2.571	1.819	3.898	6.665	.126		2.439	1.703	1.654
32	4.704	2.716	1.632	3.234	7.116	.022		2.532	3.382	1.792
33	3.107	3.147	1.797	2.399	3.928			1.584	1.871	1.805
34	2.458	2.189	1.428	2.346	2.427	.142		1.331	1.267	1.517
35	2.169	1.859	1.701	1.951	3.932	.022		1.640	1.617	.324
36	1.546	3.330	1.826	1.972	1.319			.725	1.289	.949
37	.344	1.139	1.712	1.031	1.624			.405	.428	.284
38	.898	1.092	1.395	1.025	1.113			.226	.095	.155
39	.749	1.047	.292	1.235	.346			.152	.256	.373
40	.399	.618	1.357	.929	.594			.043	.295	.303
41	.541	.286	.953	.758	.152			.212	.041	.027
42	.070	.237	.670	.908	.276					.132
43	.230	.190	.538	.360					.041	
44	.169		.362	.041						.033
45	.055	.096	.511	.082	.276					.063
46	.109	.096	.540	.232						
47		.190	.406	.232	.084				.041	.033
48			.043			.006				

APPENDIX TABLE 28, CONT.

WINTER FLOUNDER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49		.095	.185			.047				
50		.047				.010				
51		.047	.123			.028				
52		.047				.010				
53			.123			.018				
54										
55			.043	.045		.017				
TOTAL:	98.918	35.907	29.886	94.704	131.579	9.340	0.132	19.647	72.665	105.233
AVE.LN:	44.6	899.72	32.99	23.25	25.17	21.11	24.50	29.64	22.64	21.89

APPENDIX TABLE 29. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of SUMMER FLOUNDER for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	1.20	0.54 - 1.86	1.17	0.32 - 2.03	1.02
1979	0.61	0.26 - 0.95	0.37	0.15 - 0.60	1.63
1980	0.62	0.36 - 0.88	0.36	0.22 - 0.50	1.71
1981	1.04	0.55 - 1.55	1.19	0.43 - 1.96	0.87
1982	1.37	0.58 - 2.15	2.03	0.90 - 3.16	0.67
1983	1.20	0.79 - 1.60	1.18	0.79 - 1.57	1.02
			AUTUMN		
1978	0.83	0.51 - 1.16	0.55	0.33 - 0.78	1.51
1979	0.26	0.04 - 0.49	0.17	0.02 - 0.32	1.58
1980	0.71	0.40 - 1.02	0.50	0.25 - 0.75	1.41
1981	0.63	0.36 - 0.89	0.77	0.44 - 1.10	0.81
1982	1.36	1.01 - 1.72	1.75	1.26 - 2.23	0.78
1983	0.86	0.53 - 1.19	0.75	0.44 - 1.06	1.15

APPENDIX TABLE 30.

SUMMER FLOUNDER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28		.048								
29										
30		.048								
31	.055									
32		.142								
33	.060					.055				
34	.060	.047								
35	.115	.048								
36	.109	.095	.080							
37		.095	.062							
38	.060	.144	.080				.066			
39	.190	.285				.056				
40	.169	.190	.080			.236				
41	.164	.190				.120	.257			
42	.060	.095	.283			.056	.132	.080		
43	.197	.191				.077	.059			
44	.388	.142				.165				
45	.070	.142	.080			.242			.048	
46		.429				.077	.191	.077	.048	
47		.096				.131	.132		.048	
48	.060	.238	.062			.077	.118			

APPENDIX TABLE 30, CONT.

SUMMER FLOUNDER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
49		.096	.062			.251				
50		.095	.062			.230	.125			
51		.048	.062			.142			.048	
52	.060	.047				.055			.048	
53		.095							.095	
54	.055					.022				
55						.055	.059			
56						.044				
57										
58										
59										
60									.048	
61		.047								
62										
63			.062							
64										
65										
66	.055									
67										
68		.048								
69										
70										
71										
72										
73			.071							
TOTAL:	1.926	3.141	1.042			2.087	1.139	0.157	0.382	
AVE.LN:	41.85	43.15	46.13			45.98	45.02	43.97	50.88	

APPENDIX TABLE 31. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of AMERICAN PLAICE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	1.81	1.05 - 2.56	20.39	6.77 - 34.01	0.09
1979	4.00	3.44 - 4.56	51.28	39.04 - 63.53	0.08
1980	5.17	3.97 - 6.37	88.33	60.69 -115.97	0.06
1981	6.97	4.74 - 9.20	73.46	40.62 -106.29	0.10
1982	5.38	3.74 - 7.01	52.73	34.76 - 70.70	0.10
1983	5.50	1.95 - 9.04	35.67	11.01 - 60.33	0.15

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	2.96	1.83 - 4.09	59.79	29.58 - 90.01	0.05
1979	1.42	0.70 - 2.14	16.63	9.02 - 24.24	0.09
1980	2.91	2.01 - 3.81	36.95	23.83 - 50.06	0.08
1981	1.64	0.59 - 2.69	14.21	4.78 - 23.64	0.12
1982	2.58	1.16 - 4.00	21.00	10.66 - 31.34	0.12
1983	2.27	1.34 - 3.19	42.18	25.13 - 59.24	0.05

APPENDIX TABLE 32.

AMERICAN PLAICE :

Stratified mean number per tow (untransformed) by length frequency for regions 1-5 Massachusetts inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6					.053					
7					.501					
8				.035	.421					.160
9					1.175					.160
10				.276	.581				.497	4.757
11				.482	1.317				1.204	16.579
12				.311	.843	.056			3.386	29.162
13				.436	.506				7.064	28.107
14				.266	1.095	.056		.154	6.035	11.907
15				.125	.688				4.710	5.073
16				.276	2.777				2.739	3.013
17				.717	3.675				1.736	2.251
18				1.542	3.772				1.395	2.887
19				1.300	6.027	.056			.843	3.441
20				1.464	7.660				1.450	4.665
21				1.113	8.163				1.139	3.785
22				.632	8.873	.056			3.892	3.251
23				.707	14.140				2.945	3.111
24				.432	8.964				1.269	2.246
25				1.180	12.793				1.174	1.903
26				1.301	9.330				1.174	2.219
27				1.275	9.889				.963	2.464
28				1.717	4.410				.532	2.352
29				1.257	5.410				.482	2.142
30				.714	5.057				1.389	2.199
31				.502	4.023				.502	.582
32				.470	3.210				.391	1.058
33				.441	3.204				.035	1.241
34				.562	3.888				.206	.846
35			.159	.403	2.134				.276	.186
36				.221	2.098					.027
37				.175	.828				.125	
38				.045	1.242				.080	.211
39				.035	.084				.045	.027
40				.035	.528				.035	
41					.275					.160
42				.161	.742				.035	
43				.035	.053					
44				.080	.446				.045	.133
45					.084					
46					.297					
47					.053					.027
48			.072	.035	.046					

APPENDIX TABLE 32, CONT.

AMERICAN PLAICE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49				.045	.099					
50				.035	.275					
51					.053					
52				.035	.053					
53					.169					
TOTAL:			0.232	20.875	142.004	0.223		0.154	47.792	142.328
AVE.LN:			39.06	24.23	24.85	16.75		14.00	18.28	16.03

APPENDIX TABLE 33. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of WITCH FLOUNDER for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.99	0.48 - 1.49	1.37	0.74 - 1.99	0.72
1979	0.64	0.15 - 1.12	0.62	0.19 - 1.05	1.03
1980	0.65	* - 1.43	0.68	* - 1.45	0.97
1981	1.46	* - 3.23	1.71	* - 3.50	0.85
1982	0.44	* - 0.93	0.56	* - 1.13	0.79
1983	0.59	0.22 - 0.95	0.97	0.31 - 1.64	0.60

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	1.07	0.35 - 1.80	1.07	0.46 - 1.67	1.01
1979	0.50	* - 1.03	0.63	* - 1.32	0.79
1980	0.83	0.12 - 1.54	0.77	0.14 - 1.40	1.07
1981	0.11	* - 0.25	0.16	* - 0.41	0.65
1982	0.35	0.13 - 0.56	0.56	0.04 - 1.09	0.62
1983	1.22	0.30 - 2.14	1.72	0.48 - 2.96	0.71

* Negative lower limit.

APPENDIX TABLE 34. WITCH FLOUNDER :

Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18					.053					
19					.053					
20					.244					
21					.080					
22					.133					
23					.080					
24					.053					
25					.138					
26					.164					
27					.133					
28					.160					.027
29					.080					
30					.053					
31					.053					.080
32										.027
33					.046					.264
34				.086						.053
35				.041	.111				.045	.105
36				.041						.133
37				.125						.133
38					.027				.045	.185
39				.041	.130					.132
40				.035	.053				.035	.316
41					.084				.045	.238
42					.084				.080	.237
43					.063					.343
44					.084				.045	.448
45										.580
46				.090	.453					.764
47				.045	.109					.421
48				.041	.220					.343

APPENDIX TABLE 34, CONT.

WITCH FLOUNDER :
Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49					.084				.045	.178
50				.045	.147					.843
51					.084					.421
52				.045	.084					.211
53									.035	.237
54					.169					
55									.045	.316
56				.041						
57				.041	.084				.045	
58										.211
59				.045						
60				.045						
61										.105
62										.105
63										
64										
65										
66					.027					
TOTAL:				0.807	3.622				0.467	7.456
AVE.LN:				44.94	37.35				45.10	45.99

APPENDIX TABLE 35. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of WINDOWPANE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
SPRING					
1978	9.08	6.08 - 12.09	31.48	21.12 - 41.85	0.29
1979	8.46	5.42 - 11.50	30.12	19.78 - 40.47	0.28
1980	8.36	4.91 - 11.81	28.28	16.78 - 39.77	0.30
1981	11.12	6.90 - 15.34	36.83	22.43 - 51.23	0.30
1982	11.40	2.95 - 19.85	44.39	7.21 - 81.56	0.26
1983	7.16	4.79 - 9.53	23.62	16.40 - 30.83	0.30
AUTUMN					
1978	0.98	0.53 - 1.42	5.26	2.49 - 8.03	0.19
1979	1.91	1.19 - 2.63	8.49	5.59 - 11.39	0.22
1980	1.64	1.02 - 2.27	7.60	4.75 - 10.44	0.22
1981	1.09	0.51 - 1.68	7.78	2.67 - 12.89	0.14
1982	1.64	0.86 - 2.41	7.40	4.11 - 10.69	0.22
1983	0.86	0.53 - 1.18	4.45	2.56 - 6.33	0.19

APPENDIX TABLE 36.

WINDOWPANE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										.033
4										
5						.390				.092
6						.446	.059	.154		
7		.095				.948	.066	.080		
8	.055			.048		.779				.066
9				.048		.333	.066	.043	.041	.033
10	.055			.034		.165		.077		.092
11	.070					.109		.077		
12			.203	.095		.274		.148		
13	.055			.048	.126			.148		
14	.130	.048	.159	.184	.339					
15	.399	.048	.230	.295	.348				.041	
16	.355	.192	.212	.432	.428	.115		.154		
17	.295	.192	.389	.807	.776	.022		.071	.041	
18	.299		.292	1.107	1.400	.077		.071	.178	
19	.631		.455	1.474	.830	.022	.059		.130	
20	.512	.144	.150	1.402	.189	.155			.089	
21	1.145	.382	.697	.555	.096	.181		.071	.266	
22	.434	.189	.752	.261	.132	.322			.676	.317
23	.637	.238	.611	.041		.267		.398	.445	.383
24	.572	.524	.585	.048	.099	.355		.304	.423	.800
25	.440	1.000	1.221	.034	.372	.177		.167	.362	.397
26	1.016	2.288	1.795	.198	.579	.078		.375	.353	.390
27	1.085	4.094	2.413	.116	1.206	.223	.184	.241	.260	.645
28	1.052	5.471	3.672	.394	.938	.166	.132	.543	.348	.199
29	.855	7.088	3.342	.504	.619	.022		1.775	.336	.245
30	1.000	7.845	3.661	.302	.195			.843	.479	.199
31	1.079	7.189	3.900	.368	.132		.059	.531	.288	.033
32	.551	6.951	1.149	.143	.462	.022		.533	.247	.033
33	.648	4.759	1.353	.177	.066			.077	.041	
34	.115	2.810	.761	.082	.046			.408		
35	.055	2.049	1.495	.048	.099			.274		.033
36	.022	1.476	.663				.066	.212		
37		.957	.734					.080		
38		1.196	.424		.033			.043		
39	.055	.525	.150							.033
40		.237	.071						.041	
41		.047								
42										
43				.034						
TOTAL:	13.615	58.031	31.540	9.281	9.513	5.648	0.691	7.896	5.084	4.024
AVE.LN:	25.17	30.43	28.62	21.30	22.92	13.77	22.29	27.13	25.35	24.34

APPENDIX TABLE 37. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of ATLANTIC HERRING for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	0.29	* - 0.69	34.56	* - 91.11	0.01
1979	0.67	* - 1.36	17.35	0.35 - 34.35	0.04
1980	0.63	0.06 - 1.21	14.89	* - 32.17	0.04
1981	0.37	0.04 - 0.70	5.66	* - 13.55	0.07
1982	0.12	0.01 - 0.22	2.74	* - 5.58	0.04
1983	0.93	* - 2.20	22.93	* - 53.35	0.04
			AUTUMN		
1978	0.41	0.03 - 0.80	8.51	* - 17.18	0.05
1979	0.03	* - 0.07	5.36	* - 15.29	0.01
1980	0.10	0.01 - 0.19	1.49	0.31 - 2.67	0.07
1981	0.09	0.01 - 0.18	1.09	0.00 - 2.18	0.09
1982	0.16	0.01 - 0.31	3.92	* - 8.68	0.04
1983	0.57	0.11 - 1.03	7.19	0.68 - 13.70	0.08

* Negative lower limit.

APPENDIX TABLE 38.

ATLANTIC HERRING :

Stratified mean number per tow (untransformed) by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3			.080							
4				.041						
5				.454	.027					
6				.330	.165					
7										
8										
9										
10										
11					.063					
12				.206	.033					.090
13				1.885	.063					
14				3.793	.189					
15				10.494	.252					.027
16				45.954	.507					.080
17				26.816					.216	.608
18				4.252	.129				.714	3.114
19				.251					.744	7.840
20				.035	.066				.963	7.139
21									1.502	4.861
22			.072		.066				.637	2.449
23			.072						.246	.904
24									.115	.160
25									.140	.080
26				.080						.027
27										.053
28										
29					.063					.027
30										.027
TOTAL:			0.225	94.592	1.623				5.277	27.484
AVE.LN:			15.58	16.04	15.09				20.35	19.91

APPENDIX TABLE 39. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of BUTTERFISH for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	0.16	* - 0.34	1.14	* - 2.34	0.14
1979	0.02	* - 0.06	0.28	* - 0.67	0.08
1980	0.38	* - 0.87	5.46	* -11.02	0.07
1981	0.11	* - 0.28	0.99	* - 2.40	0.11
1982	0.01	0.00 - 0.02	0.10	* - 0.20	0.10
1983	0.12	0.01 0.22	1.16	0.31 - 2.02	0.10
			AUTUMN		
1978	1.42	0.95 - 1.89	132.68	85.97 -179.40	0.01
1979	0.89	0.62 - 1.16	74.55	51.58 - 97.51	0.01
1980	4.61	1.99 - 7.23	418.75	177.91 -659.59	0.01
1981	2.38	1.53 - 3.22	102.78	66.14 -139.14	0.02
1982	1.65	0.31 - 2.99	174.04	13.75 -334.34	0.01
1983	1.91	1.40 - 2.41	162.92	118.16 -207.68	0.01

* Negative lower limit.

APPENDIX TABLE 40. BUTTERFISH :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2							.650			
3						1.381	1.673	.542	.069	
4						3.803	8.891	10.652	.137	
5						27.310	31.678	24.210	.240	.105
6						52.848	48.283	50.676	.254	.105
7	.022					94.181	35.257	5.848	1.493	
8						183.556	26.429	7.123	8.115	4.566
9						75.473	2.939	10.041	14.115	12.070
10	.130	.095				24.173	1.282	7.272	15.555	4.841
11	.699	.047	.159			10.058	.527	10.082	2.369	2.140
12	.184	.191	.159			2.792	.659	5.872	1.264	1.793
13	.115	.239				1.384	.066	1.014	.665	.315
14		.096				1.497	.066	.072	.537	.046
15		.048				.962			1.290	.099
16	.055	.142				1.000		.217	2.685	.339
17	.109	1.040				.167			1.870	.346
18	.055	1.323				.110			1.091	.157
19		.615				.078			.529	.105
20		.189							.221	.027
21		.047							.086	
TOTAL:	1.369	4.073	0.319			480.775	158.400	133.621	52.587	27.056
AVE.LN:	12.10	16.98	11.50			7.78	6.33	6.96	10.44	9.71

APPENDIX TABLE 41. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of AMERICAN SAND LANCE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	2.80	* - 6.05	243.32	* - 509.45	0.01
1979	0.88	* - 2.14	117.65	* - 274.21	0.01
1980	1.90	* - 4.34	202.88	* - 506.07	0.01
1981	2.13	0.85 - 3.42	233.16	107.40 - 358.93	0.01
1982	2.11	* - 5.43	284.28	* - 763.90	0.01
1983	0.17	0.00 - 0.34	23.31	9.97 - 56.60	0.01

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.10	* - 0.22	26.35	* - 64.77	< 0.01
1979	0.06	* - 0.16	12.46	* - 33.23	< 0.01
1980	0.03	* - 0.07	4.83	* - 11.26	0.01
1981	0.03	* - 0.07	6.06	* - 14.00	< 0.01
1982	1.55	* - 4.35	352.59	* - 998.88	< 0.01
1983	< 0.01	< 0.01	0.04	* - 0.88	< 0.01

* Negative lower limit.

APPENDIX TABLE 42.

AMERICAN SAND LANCE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3			.062							
4			.123							
5			.319							
6			.080							
7										
8										
9	.070		.797							
10	.512		13.312							
11	2.228		54.920	.041						
12	3.949		54.609	.445						
13	1.731		8.989	2.225		.056				
14	.846		1.043	1.963						
15	.542		1.797	.642		.056				
16	.279	.048	.804	.095						
17	.179	.048	.779							
18			.478	.048						
19			.301	.041						.063
20			.159	.048						
TOTAL:	10.336	0.096	138.572	5.548		0.111				0.063
AVE.LN:	12.35	16.50	11.58	13.69		14.00				19.00

APPENDIX TABLE 43. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of SPINY DOGFISH for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	23.57	* - 47.69	11.24	* - 27.40	2.10
1979	6.41	3.38 - 9.44	1.85	0.80- 2.92	3.45
1980	6.14	2.15 - 10.14	1.70	0.51- 2.89	3.62
1981	6.90	0.59 - 13.20	1.55	0.05- 3.06	4.44
1982	9.29	1.98 - 16.60	1.98	0.40- 3.57	4.68
1983	3.26	1.48 - 5.05	0.84	0.39- 1.30	3.88
			AUTUMN		
1978	229.71	48.56 -410.85	151.71	28.29-275.12	1.51
1979	40.17	6.17 - 74.17	12.55	3.49- 21.62	3.20
1980	18.55	* - 46.75	4.96	* - 12.49	3.74
1981	46.37	* -104.17	11.57	* - 25.88	4.01
1982	180.36	* -391.44	54.07	* -114.18	3.34
1983	40.56	* - 85.92	14.67	* - 29.83	2.76

* Negative lower limit.

APPENDIX TABLE 44.

SPINY DOGFISH :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

REGIONS

	SPRING					AUTUMN				
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26								.043		
27										
28										
29										
30										
31										
32										
33								.043		
34										
35										
36								.043		
37								.043		
38										
39										
40								.043		
41								.087		
42								.087		
43										
44										
45										
46								.087		
47								.087		
48								.087		

APPENDIX TABLE 44, CONT.

SPINY DOGFISH :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49								.043		
50								.174		
51								.043		
52								.087		
53								.130		
54										
55								.628		
56								.130		
57								.043		
58								.130		
59								.072		
60								.522		
61								1.406		
62								.406		
63								1.275		
64								1.159		
65								1.725		
66								1.671		
67								.551		
68	.070							2.029		
69								2.159		
70								3.768	.041	
71								4.918		
72								3.507		
73								3.990		
74								5.981		
75								2.904		
76								3.426		
77								2.469		
78								3.275	.041	
79								2.580		
80								2.426		
81								1.696	.041	
82								1.783		
83								1.696		
84								1.009	.041	
85								.507	.048	
86								1.725		
87								1.565		
88								2.647		
89								1.000		
90								.855	.095	
91								.435		
92								.642		
93								3.696	.088	
94								2.435	.048	
95								3.642	.134	
96								1.130	.089	

APPENDIX TABLE 44, CONT.

SPINY DOGFISH :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

REGIONS

	SPRING					AUTUMN				
CMS	1	2	3	4	5	1	2	3	4	5
97								3.696	.165	
98								4.261	.039	
99								4.565	.045	
100								1.589	.041	
101								1.154	.093	
102								1.696	.130	
103								1.130		
104									.041	
105								.512	.048	
106									.041	
107									.041	
TOTAL:	0.070							99.346	1.402	
Ave. Ln.:	68.00							81.33	95.28	

APPENDIX TABLE 45. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of LITTLE SKATE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	14.10	6.74 - 21.46	32.09	9.48 - 54.71	0.44
1979	18.22	12.58 - 23.85	38.11	24.65 - 51.57	0.48
1980	11.93	7.88 - 15.98	25.83	16.51 - 35.16	0.46
1981	26.94	19.63 - 34.26	54.58	38.78 - 70.37	0.49
1982	15.34	6.93 - 23.75	38.52	12.46 - 64.58	0.40
1983	10.05	7.71 - 12.40	17.01	13.45 - 20.58	0.59

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	6.43	4.46 - 8.41	11.21	7.75 - 14.67	0.57
1979	15.28	10.70 - 19.86	28.87	19.90 - 37.84	0.53
1980	13.82	8.96 - 18.67	27.59	16.06 - 39.11	0.50
1981	7.31	4.60 - 10.02	13.28	7.75 - 18.81	0.55
1982	16.48	12.35 - 20.60	30.77	22.92 - 38.62	0.54
1983	8.68	6.06 - 11.31	17.30	10.69 - 23.90	0.50

APPENDIX TABLE 46.

LITTLE SKATE :

Stratified mean number per tow (untransformed) by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										.165
5										
6										
7										
8										
9									.124	
10									.247	
11		.095				.055			.247	
12									.590	
13				.048					.171	.092
14									.625	
15									.638	.059
16	.060			.095					.495	.165
17									.357	.092
18					.053			.080	.707	.367
19				.089	.084				1.009	.119
20	.055			.089	.033				.536	.237
21	.199			.089		.056			.576	
22				.223				.077	.802	
23	.115			.130	.129	.056		.080	.384	.172
24				.048				.077	.260	.178
25	.022		.072	.178	.132			.159	.308	.079
26	.404	.048		.045		.115			.301	.188
27	.077	.095		.048	.033	.056			.686	.450
28	.251	.144		.191	.033	.115		.239	.884	.033
29	.322	.192		.321	.199	.022	.066	.389	.568	.099
30	.246	.047		.165	.232	.252		.234	.343	.241
31	.339	.048	.062	.349	.225	.056		.313	.793	.192
32	.426	.239	.080	.141	.199	.400		.157	.717	.277
33	.219	.047	.123	.450	.228	.087		.077	.555	.033
34	.678	.190	.080	.505	.063	.087		.541	.942	.172
35	.448	.287	.159	.602	.099	.377	.264	.470	.929	.311
36	.240	.192	.223	.286	.265	.311		.234	.485	.188
37	.634	.287	.194	.511	.099	.424	.066	.390	.609	.165
38	.579	.144	.062	.404	.567	.415	.066	.159	.362	.307
39	.623	.335		.559	.258	.350	.132	.627	.238	.403
40	1.251	.575	.344	.602	.265		.066	.693	.565	.211
41	.917	.620	.406	.846	.284	.197	.250	.618	.574	.559
42	1.201	.573	.353	.730	.184	.662	.250	.399	.382	.165
43	1.758	.859	.761	.594	.165	.619	.698	.470	.600	.132
44	3.107	1.001	.531	.519	.099	1.372	.902	.949	.622	.238
45	4.799	1.814	1.114	.628	.165	1.439	1.364	1.633	.457	.621
46	4.895	2.292	.955	.956	.237	2.433	1.336	2.511	.787	.374
47	4.549	1.816	1.167	.751	.099	1.586	1.187	1.878	.756	.536
48	4.108	2.103	.750	1.433	.159	1.117	1.107	1.173	1.476	.490

APPENDIX TABLE 46, CONT. LITTLE SKATE :

Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49	1.851	.477	.654	1.149	.162	.842	.705	.995	1.784	.615
50	.913	.429	.520	1.235	.096	.415	.125	.547	2.050	.377
51	.055	.143	.274	1.225	.525	.208	.066	.159	1.607	1.497
52	.266	.144		.821	.099			.080	1.386	.536
53	.055			.312	.150				.587	.678
54				.374	.066				.616	1.022
55			.062	.260	.119				.219	.178
56		.095		.219	.066				.082	.165
57			.072	.041	.122					.297
58					.099					.059
59										.119
60										
61										.297
TOTAL:	35.661	15.330	9.016	18.258	6.096	14.122	8.649	16.408	31.037	13.949
AVE.LN:	43.54	43.76	44.57	42.76	40.46	43.13	45.12	42.36	36.01	42.21

APPENDIX TABLE 47. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of WINTER SKATE for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	12.92	8.04 - 17.80	4.57	2.57 - 6.57	2.83
1979	15.62	9.07 - 22.18	5.45	3.21 - 7.68	2.87
1980	15.96	10.95 - 20.96	9.52	5.58 - 13.47	1.68
1981	44.30	32.61 - 55.99	39.60	28.40 - 50.80	1.12
1982	31.27	18.88 - 43.66	20.23	9.63 - 30.83	1.55
1983	25.92	17.04 - 34.79	17.91	13.64 - 22.18	1.45

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	7.86	2.09 - 13.63	3.96	1.90 - 6.01	1.99
1979	10.60	7.17 - 14.04	5.56	3.77 - 7.35	1.91
1980	15.96	6.53 - 24.42	8.60	5.50 - 11.71	1.80
1981	11.90	7.76 - 16.04	7.60	5.16 - 10.04	1.57
1982	31.77	22.65 - 40.88	18.33	12.79 - 23.86	1.73
1983	15.59	7.77 - 23.42	11.98	6.84 - 17.12	1.30

APPENDIX TABLE 48.

WINTER SKATE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										.059
14								.077		
15										
16										
17								.080		
18								.072		
19								.072		.119
20								.080		
21			.132					.080		
22	.070							.301		
23	.139		.105					.236		.063
24	.139		.203					.385		.099
25	.194	.047	.141					.154		.066
26	.399		.397					.434		.033
27	.250	.047	.132			.111		.388		
28	.314	.190	.793					.374		
29	.239	.048	.661					.390		.063
30	.194	.047	1.060			.056		.750		
31	.796	.096	1.750			.223		.360		.033
32	.249	.238	2.473			.167	.132	.380		.059
33	.374	.383	3.082			.056	.125	.571		.033
34	.447	.429	2.120			.223	.059	1.297		.059
35	.624	.429	2.580	.034		.279	.389	.914		.066
36	.589	.908	1.359	.048		.223	.323	1.593		.059
37	.682	1.291	2.931	.088		.111	.264	1.914		.178
38	.933	.862	2.332			.111	.389	1.938		.059
39	.773	.812	2.268	.143	.033	.056	.323	.929		.096
40	.843	1.098	1.650	.130		.111	.191	2.060		.092
41	.448	1.528	2.404	.095	.066	.056	.191	2.522		.063
42	.344	1.144	2.569	.041	.033	.222	.375	2.553		
43	.429	1.001	1.580	.034	.033	.055	.250	2.290	.041	.119
44	.589	.810	1.721	.048	.033		.132	.918		
45	.423	.953	1.236	.082		.223	.250	2.404		.063
46	.022	.525	1.272	.034			.125	1.108		.096
47	.320	.619	1.085		.033	.056	.375	1.556		.033
48	.175	.383	.821			.110	.191	1.614		.152

APPENDIX TABLE 48, CONT.

WINTER SKATE :

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

REGIONS

	SPRING					AUTUMN				
CMS	1	2	3	4	5	1	2	3	4	5
49		.525	1.185			.111	.191	1.102		
50		.238	1.393				.066	1.851		
51	.120	.190	.246				.059	1.644		.059
52	.070	.380	.558			.056	.066	2.389		
53	.179	.144	.723		.033		.191	1.190	.048	.126
54	.070	.335	.476		.033		.059	1.578		
55	.070	.096	.467		.066		.066	.784		.225
56		.048	.795	.095	.099		.125	1.265	.089	.840
57	.070	.144	1.125		.066		.066	1.034		.631
58	.130	.192	.929		.033		.066	1.064	.041	.291
59	.070	.143	1.565	.048	.117		.066	1.042	.041	
60	.358	.096	1.170	.034				1.001		.238
61	.060	.095	1.212		.033			.763		.224
62		.096	1.547		.033		.066	1.257		.063
63	.082	.047	1.804					.770	.041	
64	.060	.096	.196	.041				.688		.066
65		.047	1.424					.831		.059
66	.109	.048	1.257		.033			.753		
67	.240	.143	1.246					.625		.066
68	.164	.048	.866		.033			.866		.033
69		.143	.875		.033			.977	.048	
70		.096	.645					.825	.041	.066
71		.096	1.152	.048	.033			.352		.033
72	.070	.048	1.071		.033			.439		.119
73	.109	.048	.859					.357		
74	.060	.048	.937					.666		.185
75		.047	.752					.389		.033
76	.146		.114					.149		.033
77		.096	1.159					.616		
78			.946	.045				.468	.034	.033
79			1.062					.274		
80		.096	.547					.234		.066
81		.047	.310					.880		.119
82	.055		.371					.362		
83	.060	.048	.866					.077	.075	.033
84	.060		.254		.063			.077		.033
85	.060		.830					.390		.033
86			.538					.120		.092
87		.048	.399					.236	.041	
88			.533					.154	.048	.099
89	.070	.047	.114					.080		.066
90		.096	.761					.080	.048	.066
91			.326					.157		.033
92		.048	.141					.157		.033
93			.210					.043		
94			.406					.080		
95			.159							
96		.095						.077		

APPENDIX TABLE 48, CONT.

WINTER SKATE :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
97			.239							
98			.451							
99								.072		
100			.221					.077		
101	.070							.080		
102										
103			.043							
104										
105								.080		
TOTAL:	13.609	18.188	76.332	1.091	0.974	2.616	5.169	62.318	0.634	5.802
AVE.LN:	42.07	45.15	52.91	46.99	57.46	37.99	43.11	51.10	68.95	55.73

APPENDIX TABLE 49. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of LONGFIN SQUID for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	0.66	0.25 - 1.08	6.47	3.02 - 9.93	0.10
1979	2.11	1.06 - 3.16	25.87	10.62 - 41.12	0.08
1980	2.72	1.04 - 4.40	20.73	9.00 - 32.46	0.13
1981	0.56	0.19 - 0.93	6.21	2.94 - 9.48	0.09
1982	0.69	0.07 - 1.31	8.48	3.56 - 13.41	0.08
1983	3.58	1.16 - 6.01	46.20	26.22 - 66.18	0.08

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	4.18	2.93 - 5.43	560.33	15.07-1105.60	0.01
1979	2.66	1.70 - 3.62	362.34	194.15 -530.53	0.01
1980	3.12	2.26 - 3.97	265.44	199.10 -331.78	0.01
1981	3.68	2.96 - 4.41	284.80	207.44 -362.15	0.01
1982	3.64	2.34 - 4.95	650.86	420.77 -880.95	0.01
1983	3.16	1.48 - 4.84	406.72	294.53 -518.92	0.01

APPENDIX TABLE 50.

LONGFIN SQUID :

Stratified mean number per tow (untransformed) by length frequency for regions 1-5 Massachusetts inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1						13.809	21.277	12.016	26.917	
2	.430	.095	.301			175.487	89.683	26.168	226.391	41.116
3	14.559	4.747	4.763			62.920	49.240	10.995	228.767	130.741
4	21.520	12.778	6.455			47.443	24.452	8.678	140.810	50.392
5	10.645	7.369	4.774			46.877	37.380	9.812	48.684	13.244
6	5.074	3.041	1.036			34.086	55.109	3.935	11.192	2.285
7	2.578	1.621	.159			22.090	55.195	6.334	4.359	1.393
8	1.005	.903				22.168	35.642	1.736	4.286	2.343
9	.408	2.090	.301			12.502	17.096	3.746	.919	1.456
10	.786	1.525	.353			7.626	14.836	2.063	.637	
11	3.628	3.234	.451			5.204	13.295	.708	.130	.155
12	1.798	4.511				2.510	6.651	.708	.189	.092
13	3.320	6.891	.080			.439	.125	.072	.069	
14	2.795	9.165				.681	.389	.071	.069	.211
15	3.225	10.017	.132			.251	.309	.072	.726	.059
16	1.325	8.496	.062			.164			.382	.630
17	.940	8.624				.044			.464	
18	.658	5.604	.080			.153			.069	
19	.350	5.079	.080			.111				
20	.515	3.178				.273				
21	.055	3.799				.044			.334	.059
22	.153	4.180				.131			.041	
23	.060	2.993				.245			.095	
24	.109	2.800				.022			.116	
25	.115	2.233				.109			.069	.119
26	.164	2.611				.022				.059
27		2.659				.022			.103	
28		2.323				.022				
29		1.993								
30		2.566								
31		2.275								
32		1.801								
33		.995								
34		1.561								
35		1.089								
36		.521								
37		.898								
38		.473								
39		.331								
40		.142								
41		.047								
42										
43										
44										
45										
46										
47		.142								
TOTAL:	76.216	137.398	19.025			455.456	420.680	87.115	695.816	244.354
AVE.LN:	6.90	16.21	4.73			4.03	5.17	3.86	3.12	3.36

APPENDIX TABLE 51. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of AMERICAN LOBSTER for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
			SPRING		
1978	1.09	0.59 - 1.59	3.17	1.71 - 4.63	0.34
1979	0.82	0.31 - 1.33	2.34	0.61 - 4.07	0.35
1980	1.16	0.61 - 1.71	3.56	1.49 - 5.63	0.33
1981	2.77	0.63 - 4.91	10.07	1.40 -18.73	0.28
1982	1.02	* - 2.09	3.59	* - 7.94	0.28
1983	0.79	0.45 - 1.13	2.35	1.15 - 3.56	0.34
			AUTUMN		
1978	2.46	1.02 - 3.89	10.01	2.96 -17.06	0.25
1979	3.68	0.88 - 6.48	13.81	2.20 -25.41	0.27
1980	1.56	1.16 - 1.95	4.97	4.00 - 5.95	0.31
1981	1.98	0.86 - 3.09	7.40	2.75 -12.04	0.27
1982	2.14	1.02 - 3.26	6.66	2.41 -10.92	0.32
1983	3.84	1.64 - 6.04	14.70	2.83 -26.57	0.26

* Negative lower limit.

APPENDIX TABLE 52.

AMERICAN LOBSTER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30									.048	
31									.034	
32										
33										
34									.034	
35									.034	
36									.069	
37						.022			.034	.132
38									.069	.033
39									.034	.033
40									.378	.138
41						.022			.275	.199
42									.034	.099
43						.044			.275	
44		.048							.344	.199
45									.137	1.077
46	.055				.119				.316	.165
47						.022			.323	.795
48									.275	.066

APPENDIX TABLE 52, CONT.

AMERICAN LOBSTER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
49									.309	.099
50						.022			.309	.099
51					.119				.350	1.232
52						.077			.488	2.240
53					.119				.419	1.312
54	.055			.095	.119				.505	1.308
55						.022			.240	1.862
56					.126	.022			.206	1.400
57	.055	.047			.063	.056			.275	1.951
58	.109			.048	.426				.340	.927
59		.095			.119				.347	.616
60	.055			.088	.245	.060			.254	1.607
61	.109	.095		.095					.391	.280
62				.089	.063				.306	2.596
63	.109	.047							.391	1.818
64					.066	.022			.414	.132
65	.022	.047		.041	.415				.632	.422
66				.132	.063	.044			.312	1.335
67	.055			.177	.482				.177	.363
68	.055				.500				.440	.896
69	.055			.041	.203				.523	1.496
70	.109			.045	.129	.022			.337	.784
71	.022		.159		.363				.552	.587
72	.109			.166	.430	.022			.720	1.267
73				.041	.027			.077	.421	1.286
74				.171	.277				.546	1.343
75				.075	.189				.343	1.222
76				.141	.458				.342	1.071
77				.172	.231				.585	1.906
78					.210			.043	.600	1.440
79				.210	.027	.055			.376	2.692
80	.055			.048	.211				.677	.511
81					.390				.379	.636
82			.159						.176	1.345
83					.084				.305	.145
84				.048	.059					.125
85									.196	.278
86				.076				.077	.224	.178
87	.022				.192				.045	.099
88				.048					.175	.105
89				.045					.114	.363
90				.045	.084			.072	.131	.274
91								.157	.041	.467
92				.045				.043	.175	.168
93				.041					.045	.261
94				.045					.093	.178
95									.080	.105
96				.034				.043	.045	.215

APPENDIX TABLE 52, CONT.

AMERICAN LOBSTER :
Stratified mean number per tow (untransformed)by
length frequency for regions 1-5 Massachusetts
inshore bottom trawl survey, spring and autumn, 1983.

	SPRING					AUTUMN				
	R E G I O N S									
CMS	1	2	3	4	5	1	2	3	4	5
97				.041					.093	.059
98									.110	.059
99									.048	.119
100										
101										
102			.072						.045	.033
103									.114	.063
104		.095								
105										.105
106			.062							
107										
108										
109								.154	.041	
110										
111										
112										
113									.041	
114									.048	
115										
116								.080		.059
117										
118										
119								.080		
120										
121										
122										
123										
124										
125										
126									.048	
TOTAL:	1.049	0.473	0.453	2.344	6.606	0.531		0.827	18.653	46.478
AVE.LN:	61.63	67.67	84.59	74.10	69.48	57.61		96.86	66.27	66.46

APPENDIX TABLE 53. Stratified mean catch per tow (kilograms and number), estimate of precision and average weight per individual of ROCK CRAB for all Massachusetts inshore strata sets, spring and autumn, 1978 - 1983

SPRING

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	1.39	0.51 - 2.27	22.16	5.25 - 39.06	0.06
1979	1.25	0.70 - 1.80	11.57	6.72 - 16.41	0.11
1980	0.78	0.34 - 1.23	6.21	3.42 - 9.00	0.13
1981	2.10	1.42 - 2.78	18.74	11.60 - 25.88	0.11
1982	1.55	0.84 - 2.26	16.10	7.97 - 24.22	0.10
1983	0.94	0.70 - 1.18	7.19	5.05 - 9.33	0.13

AUTUMN

	Mean Wt./tow	95% Confidence Limits	Mean No./tow	95% Confidence Limits	Wt./No.
1978	3.36	2.35 - 4.37	43.74	22.68 - 64.81	0.08
1979	4.74	2.58 - 6.91	45.86	22.92 - 68.79	0.10
1980	4.14	3.17 - 5.11	55.60	28.67 - 82.53	0.07
1981	0.18	0.10 - 0.25	6.27	* - 13.59	0.03
1982	4.48	3.59 - 5.38	50.46	35.02 - 65.91	0.09
1983	2.09	1.49 - 2.70	16.16	11.66 - 20.66	0.13

* Negative lower limit.

APPENDIX TABLE 54.

ROCK CRAB

Stratified mean number per tow (untransformed)by length frequency for regions 1-5 Massachusetts inshore bottom trawl surveys, spring and autumn, 1983.

	SPRING					AUTUMN				
	REGIONS									
CMS	1	2	3	4	5	1	2	3	4	5
1						.222	.066	2.606	.103	
2	.415		.185			.275	4.278	1.788	1.704	.099
3	1.388	.096	.370	.076		1.368	.132	1.004	1.826	.033
4	.962	.286	.862			.328	.198	.072	.752	.178
5	.208	.238	.862	.184		.459	.461	.157	.609	.702
6	.279	.427	.424	.136		.109	.198	.290	.304	1.094
7	.153	.570	1.335	1.329	.053	.109	.198	1.019	.513	1.513
8	.552	1.099	1.417	3.630	.119	.044	.066	2.036	1.597	3.655
9	.743	.859	1.895	2.413	.066	.098	.132	1.409	4.234	4.008
10	.612	2.434	1.279	2.196		.258	.257	3.994	6.068	4.691
11	.940	.618	1.076	1.589	.066	.077	.198	2.392	5.171	4.444
12	.186	.095	.391	.600		.120		.333	2.562	3.355
13		.047	.072	.286	.099	.078		.212	.667	.903
14	.022		.080			.022			.171	.316
15										
16										
17										
18										
19										
20										
21									.041	
TOTAL:	6.459	6.768	10.248	12.440	0.404	3.567	6.183	17.313	26.321	25.023
AVE.LN:	6.61	8.66	7.89	9.03	9.75	4.85	3.42	7.00	8.80	9.57

Job 2: Evaluation of winter flounder year-class strength

INTRODUCTION

Assessment of recruit-sized fish has limited application as it assesses the present situation and has only short-term predictive capability. The ability of fishery managers to manage fish stocks in a timely manner is further restricted by the time required for data analysis. Assessment of prerecruit-sized fish, particularly young-of-the-year (YOY), allows implementation of management decisions prior to that year-class entering the fishery. Decisions based on YOY stock size involve many assumptions about growth and survival to maturity. If relative strength of a year-class can be detected in the first year of life and either corroborated or modified in succeeding years as the cohort matures, allocation decisions might even be "fine tuned".

To predict annual changes in winter flounder recruitment, a standardized timeseries of YOY abundance information was collected beginning in 1975. Recruitment of winter flounder from southern Cape Cod estuaries is to territorial and offshore fisheries south and east of Cape Cod (Howe and Coates, 1975). This population group has been identified as a major Massachusetts stock unit (Pierce and Howe, 1977).

Methodology for estimating YOY abundance was based on knowledge of habitat, age-group behavior, and highly localized movement patterns (Tyler, 1971). Evidence supporting the validity of the seine index for predictive changes in stock was presented in Howe _et al._, 1984.

METHODS

The seine survey was conducted in six estuaries on the southern shore of Cape Cod. Seining was restricted to the top half of the diurnal tidal cycle. Stratification based on each estuary's littoral perimeter was utilized. A total of 49 stations (147 tows) was allocated in proportion to the relative weight of each stratum (estuary). Sampling site selection was subjective, with consideration given to substrate suitability for efficient seining (i.e., beaches with less than 0.5 m tidal amplitude and smooth intertidal bottom). At each station three hauls, from a depth of 1.0-1.3 m and perpendicular to shore, were made with a 6.5 mm nylon mesh, 6 m straight seine equipped with a heavily weighted lead line to minimize escapement. Area swept was estimated by multiplying seine spread (maintained at 5.5 m with a taut spreader rope) by seining distance (measured by pace).

A FORTRAN program (YOYSTAT), written by DMF personnel, was used to calculate a mean number of YOY/m^2 for each tow. From this an average number of YOY/m^2 and a standard deviation for each stratum were calculated, and for all estuaries combined, a stratified mean, $\bar{y}_{st}$, and variance, $V_{(\bar{y}_{st})}$ were computed for each year.

Area swept was calculated as follows:

$$A_j = (G_j \times P)\, L$$

where: P = length of pace of individual (meters)

L = length of net (meters)

G_j = number of paces taken at tow j

Catch per tow was calculated as follows:

$$y_j = F_j / A_j$$

where: F_j = number of fish at tow j

A_j = area of tow j (meters squared)

Stratum means were calculated as follows:

$$\bar{y}_i = \left(\sum_{j=1}^{n_i} y_j \right) / n_i$$

where: n_i = number of tows in stratum i

Stratum variances were calculated as follows:

$$S_i^2 = \frac{1}{n_i - 1} \left[\Sigma y_j^2 - \frac{(\Sigma y_j)^2}{n_i} \right]$$

Survey stratified means and variances were calculated as follows:

$$\bar{y}_{st} = \frac{1}{\bar{N}} \sum_{i=1}^{K} N_i \bar{y}_i$$

$$V_{(\bar{y}_{st})} = \frac{1}{\bar{N}^2} \Sigma \frac{N_i S_i^2}{n_i}$$

Where: K = total number of strata

N = total weighting coefficient of all K strata

N_i = weighting coefficient of stratum i

To compare and analyze differences in stratified mean density indices between years, the Wilcoxon two-way nonparametric test was applied to each pair of years. To monitor the predictiveness of our seining methodology, we compared trends in the stratified mean density index to length frequency modes from the spring bottom trawl surveys. Prior tagging and meristic studies (Howe and Coates 1975; Howe *et al.* 1976; Pierce and Howe 1977) indicate that winter flounder may recruit to the fishery by moving from estuaries onto the inshore grounds south and east of Cape Cod, defined in bottom trawl surveys as regions 1, 2, and 3. Winter flounder length-frequency data from trawl stations in these regions were weighted and pooled.

RESULTS AND DISCUSSION

Stratified mean number of YOY ($\overline{Y}_i$) for each estuary during 1983 were among the lowest recorded during this study[1](Table 1). The stratified mean density seine index ($\overline{Y}_{st}$) for 1983 was the lowest of the nine-year timeseries (Figure 1, Table 2). When compared to other years, significant differences in $\overline{Y}_{st}$ at P=0.05 were found between 1983 and 1976, 1977, 1979, and 1980. With the exception of 1977, 1983 was the only year that was statistically different from other years and the only year with an index significantly lower than other years (Table 3). The apparently poor winter flounder year-class of 1983 should be evident in the inshore trawl survey catch of 1985 and be reflected by lower commercial landings in 1986 and 1987.

Although the 1979 seine survey index was not statistically different from other years, it was the second highest of the nine-year timeseries and may serve as further verification of the seine survey index. Winter flounder length-frequency distribution and preliminary age data provided by NMFS' Woods Hole Laboratory's Age and Growth Investigation for regions 1-3 of the 1983 spring bottom trawl survey (Figure 2) reflect the relatively strong year-classes of 1979 and 1980. Fish selected for ageing were not chosen in proportion to the numbers representative of their age class; however, the size distribution for each age group should represent that year-class during the 1983 spring survey. The asymmetrical frequency distributions of aged fish are due to the protracted spawning period of winter flounder, differential growth rates of individuals within an age group, and sexual dimorphism.

The past three spring bottom trawl surveys track the 1979 and 1980 year-classes reasonably well (Figure 3). Although the only available age data are from the 1983 survey, they are probably representative of previous years as well In 1981, the 1979 cohort is represented as two-year-old fish with a modal peak at 13 cm. In succeeding years, overlapping cohort length ranges mask year-class strength, but the robustness of the 1979 year-class can be followed. The apparently less abundant 1980 cohort, though still provisionally classified as relatively strong, did not recruit to the 1982 trawl survey at age 2 in strength but was certainly apparent one year later at age 3.

Enhanced recruitment to the commercial fishery beginning in 1980 is supported by commercial fisheries statistics. In 1980, reported landings from fishing grounds encompassing the range of movement for this population (Vineyard and Nantucket Sounds (NMFS statistical area 538), west side South Channel (521), Nantucket Shoals (526), and Southern New England (537)) showed an unprecedented annual increase of 79% to 8,270 metric tons (MT). While much of this gain was the result of an increase in effort in 1980, it is probable that a real increase in population biomass occurred as the result of the faster growing segment of the 1977 year-class recruiting to the fishery as three-year-old fish. The 1977 year-class was the largest one observed in the seine survey timeseries (Figure 1, Table 2). An additional 5% increase in landings to 8,695 MT for 1981 reflected the strength and continuing recruitment of the 1977 year-class. In 1982, landings declined 25% to 6,566 MT, but there was a substantial increase in the landings of small and "peewee" (< 33 cm) winter flounder. These landings would have included the faster growing segment of the 1979 cohort. The 1983 landings of winter flounder from these areas were essentially unchanged (-2%) at 6,429 MT, and probably reflect continued landing of an almost fully-recruited 1979 year class and the faster growing segment of the 1980 cohort.

Young-of-the-year abundance indices from estuarine seine surveys indicate that recruitment will be below average for the next several years. Each year-class recruits over several years, so year-to-year fluctuations in recruitment tend to be minimized; however, with a declining trend in year-class size and with the 1983 cohort significantly weaker than all others, no significant upturn in recruitment to the southern New England winter flounder fishery is imminent.

REFERENCES

Howe, A. B. and P. G. Coates. 1975. Winter flounder movements, growth, and mortality off Massachusetts. Transactions of the American Fisheries Society 104:13-29.

Howe, A. B., P. G. Coates, and D. E. Pierce. 1976. Winter flounder estuarine year-class abundance, mortality, and recruitment. Transactions of the American Fisheries Society 105:647-657.

Howe, A. B., T. P. Currier, S. L. Sass, and B. C. Kelly. 1984. Coastwide Fishery Resource Assessment. Massachusetts Division of Marine Fisheries.

Pierce, D. E. and A. B. Howe. 1977. A further study on winter flounder group identification off Massachusetts. Transactions of the American Fisheries Society 106:131-139.

Tyler, A. V. 1971. Surges of winter flounder, Pseudopleuronectes americanus, into the intertidal zone. Journal Fisheries Research Board Canada 28:1727-1732.

Figure 1. Stratified mean density ($\bar{y}_{st}$) for young-of-the-year winter flounder captured during seine survey from southern Cape Cod estuaries, 1975-1983.

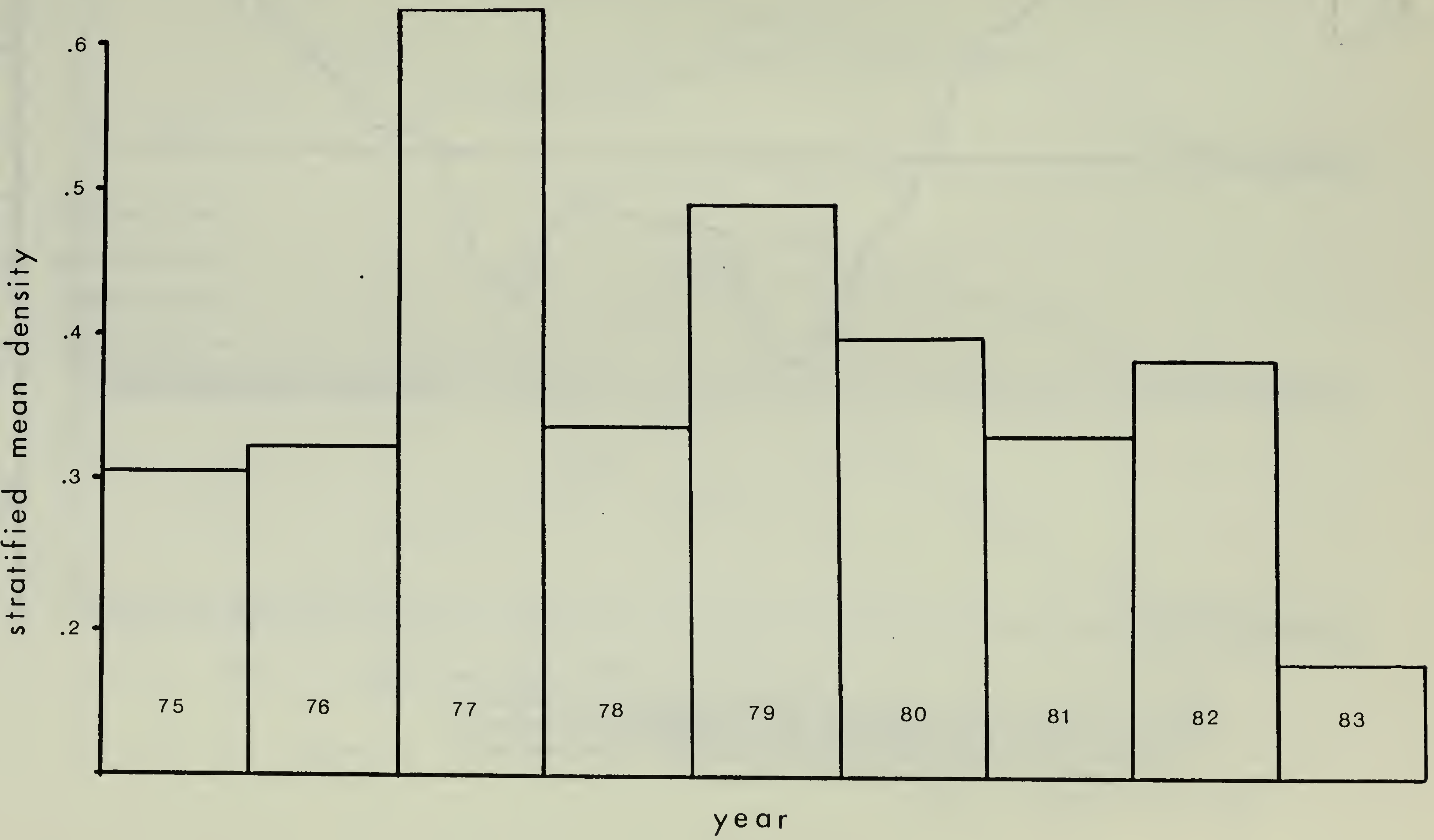

Figure 2. Trend analysis of stratified mean number/tow length frequency intervals and preliminary age distributions of winter flounder in regions 1-3 during spring, 1983 (smoothed by moving average of three).

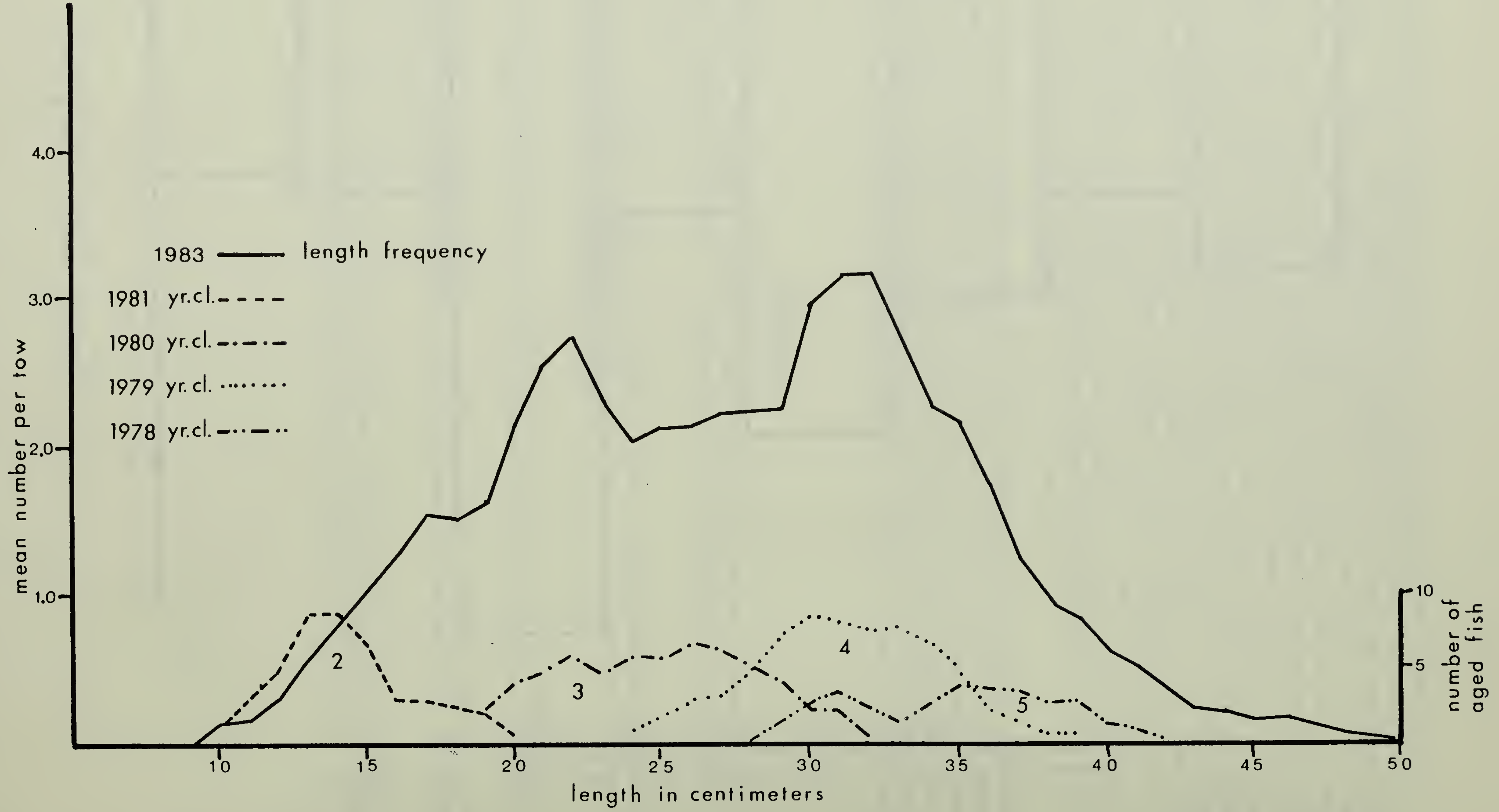

Figure 3. Stratified mean number/tow for stata south and east of Cape Cod by length frequency intervals for winter flounder captured during spring inshore bottom trawl surveys 1981-1983 (smoothed by moving average of three). Preliminary age ranges from spring, 1983 cruise, regions 1-3, and 1979 and 1980 year-class modes are shown.

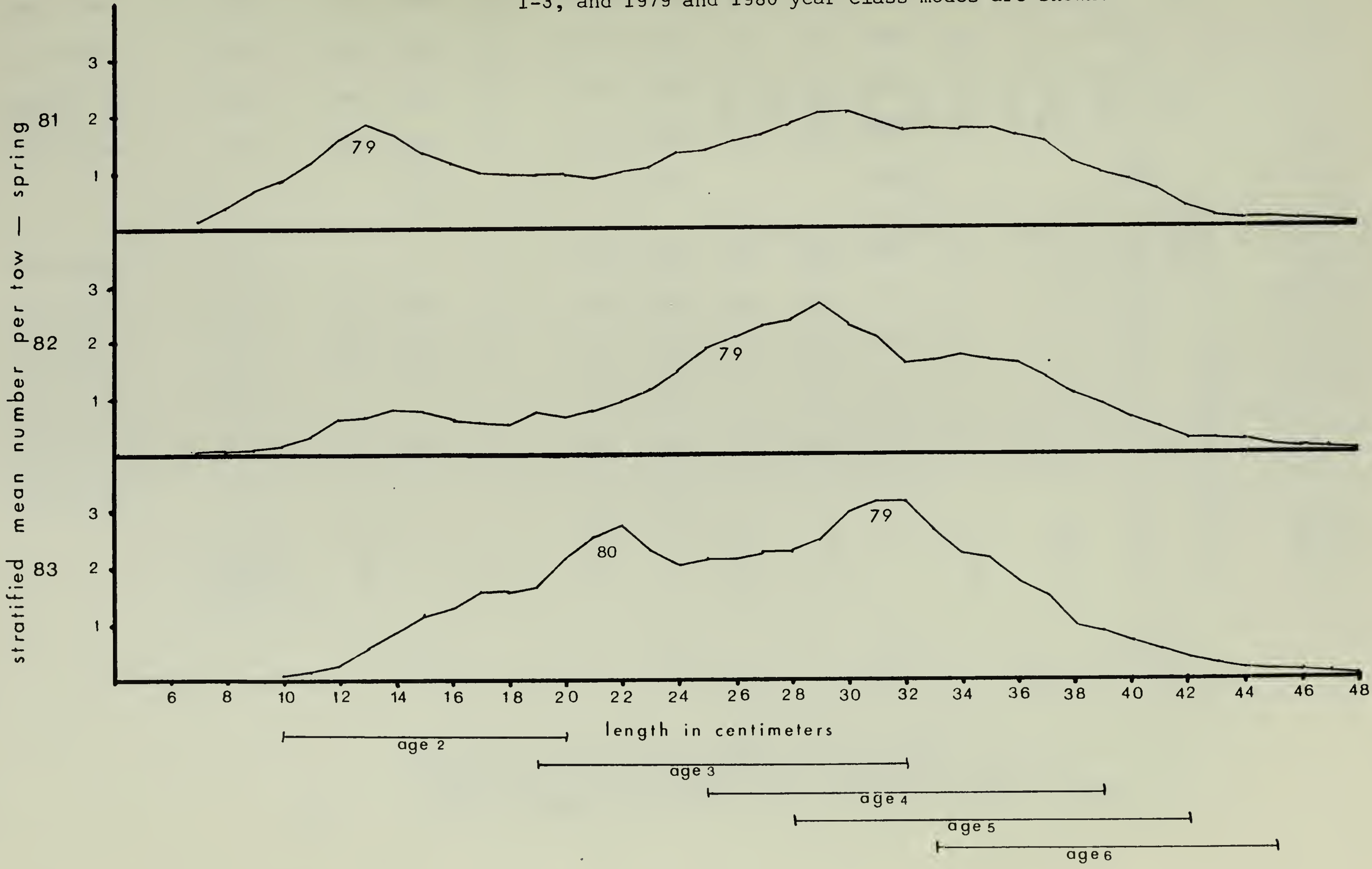

Table 1. Winter flounder mean number ($\bar{y}_i$), standard deviations, number of tows, and estuarine weighting factors for each estuary sampled on south shore of Cape Cod, 1975-1983.

	Weighting Factor (n mi)	1975			1976			1977			1978			1979		
		Mean	S.D.	# Tows	Mean	S.D.	# Tows	Mean	S.D.	# Tows	Mean	S.D.	# Tows	Mean	S.D.	# Tows
Great Pond	7.31	-	-	-	.434	.1851	18	.344	.2907	18	.346	.1669	12	.344	.4279	18
Waquoit Bay	17.38	.132	.0578	9	.379	.1316	18	.871	.5567	18	.609	.2843	18	.665	.2554	18
Cotuit Bay	24.08	-	-	-	.312	.3285	15	.468	.1342	15	.245	.2150	15	.659	.3422	15
Lewis Bay	9.37	.255	.2794	18	.566	.3391	18	1.400	.4983	18	.784	.8970	18	.591	.5349	18
Bass River	20.05	.487	.2624	15	.262	.1495	24	.612	.4110	24	.139	.1199	24	.312	.2615	24
Stage Harbor	11.66	-	-	-	.124	.1044	18	.138	.0901	18	.106	.0694	18	.195	.1593	18
		1980			1981			1982			1983					
Great Pond	7.31	.572	.3024	15	.212	.1656	15	.499	.3275	12	.206	.1320	12			
Waquoit Bay	17.38	.660	.4735	18	.622	.5053	15	.326	.3347	30	.261	.2262	30			
Cotuit Bay	24.08	.423	.2442	15	.322	.1901	15	.271	.2768	39	.135	.1060	39			
Lewis Bay	9.37	.119	.0889	18	.598	.3263	18	1.206	1.0303	15	.272	.1887	15			
Bass River	20.05	.358	.1524	24	.176	.1568	20	.319	.1862	30	.160	.1437	33			
Stage Harbor	11.66	.124	.1362	18	.041	.0437	15	.061	.0494	18	.056	.0549	18			

Table 2. Stratified mean density indices ($\bar{y}_{st}$) for young-of-the-year winter flounder, 1975-1982.

Stock Unit	Year	No. of Stations	Stratified mean density index ($\bar{y}_{st}$)	95% Confidence Limits
South coast	1975	14	0.31	0.293-0.327
	1976	37	0.33	0.318-0.342
	1977	37	0.62	0.602-0.638
	1978	35	0.34	0.322-0.358
	1979	37	0.49	0.473-0.507
	1980	36	0.40	0.386-0.414
	1981	33	0.33	0.315-0.345
	1982	48	0.38	0.359-0.401
	1983	49	0.17	0.168-0.181

Table 3. Summary of Z statistics (corrected for ties) from Wilcoxon nonparametric tests for two-way comparisons of YOY winter flounder densities (y_{st}) between years.

	76	77	78	79	80	81	82	83
75	-1.0180	-2.1740*	-0.0221	-1.4986	-0.9075	-0.1671	-0.1515	-1.1573
76		-2.1519*	-1.2627	-1.1098	-0.2300	-0.9226	-1.0328	-3.2527*
77			-2.6984*	-1.1946	-1.9971*	-2.5870*	-2.7212*	-4.3743*
78				-1.9322	-1.1156	-0.0377	-0.0922	-1.4381
79					-0.9268	-1.8410	-1.7816	-3.8859*
80						-1.0075	-0.8225	-2.8461*
81							-0.1915	-1.6617
82								-1.8760

* Significant at P = 0.05

ACME
BOOKBINDING CO., INC.

JUL 28 1990

00 CAMBRIDGE STREET
CHARLESTOWN, MASS.